# AERIAL SURVEY OF SOUTHEASTERN ALASKA 1948*

*Commander Thomas F. Pollock, U. S. Navy*

## INTRODUCTION

UNTIL March, 1948, Patrol Squadron FOUR of the U. S. Pacific Fleet Air Force had never taken an aerial photograph. Yet, on May 15, 1948, this squadron, equipped with six Neptunes and complemented with twenty six officers and one hundred thirty six enlisted men, commenced an aerial survey of Southeastern Alaska, which resulted in the successful photographic coverage of all of the Alaskan "Panhandle"—an area of 45,000 square miles. The squadron flew 23,000 linear miles of photographic flight lines and obtained the most comprehensive photographic record ever made of Southeastern Alaska on 500 rolls of aerial film.

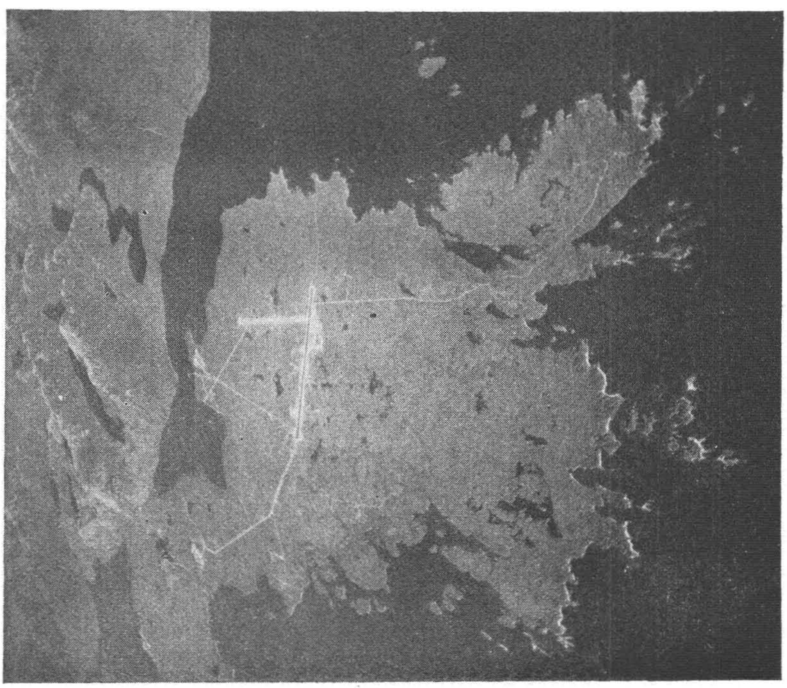
The Navy's only Pacific Fleet photographic squadron, Patrol Squadron SIXTY-ONE, was committed to a large aerial survey operation in Northern Alaska during the summer of 1948. Therefore, it became necessary to convert Patrol Squadron FOUR into a photographic squadron temporarily, in order to accomplish the vast photographic project in Southeastern Alaska during the short summer season of 1948. Conversion of VP-4 took place hurriedly with practically no chance for training inexperienced personnel. Six flight line navigators with limited aerial survey experience, two photographic officers, and eighteen aerial photographers from the special fleet photographic squadron were assigned to VP-4 for the photographic part of the survey, both as aerial camera crews and ground laboratory crews. Almost all of the two months available for preparation was drained by the photographic configuration at the factory of the six P2V-2 Lockheed Neptunes. This configuration required that the bow guns and ammunition containers be removed to make room for the flight line Navigator, his seat, and his B-3 gyro stabilized driftmeter. The top half of the solid bow had to be removed and a clear plastic nose installed to permit forward visibility for the navigator. A high altitude radar altimeter was also installed aft for obtaining more accurate altitude data. A new 6-inch cartographic precision camera was installed in the standard P2V-2 camera hatch, and two K-17, 12-inch cameras were installed in a split oblique mount in the tunnel hatch. This mount was secured to a modified tunnel escape hatch door which replaced the standard door. The two K-17, 12-inch cameras were interconnected by a linkage system which enabled the operator to adjust both cameras for crab and tilt by manipulating the controls on one unit. This mount functioned satisfactorily in operation. However, the method of positioning the cameras to the specified angle required later improvements for greater rigidity.

The pilots had completed only familiarization and instrument training phases of the qualification syllabus for this new type aircraft when the day arrived to begin their long hop northward. Up to this time, bad weather and insufficient time had prevented an air test of factory installed equipment. Therefore, the initial tests of both crews and equipment came when they were actually on their first flight lines over Prince of Wales Island in Alaska.

* "No objections to publication on grounds of military necessity, 26 April, 1949, Office of Public Information, National Military Establishment."

*Editorial Note:* The Publications Committee in discussing this article with Chief of Naval Operations (Naval Photography), points out that this survey could not have been accomplished so expeditiously and satisfactorily, without the technical assistance given by the officers and men of Photographic Squadron ONE and Mr. W. T. Reagan of the U. S. Geological Survey.

P2Vs over Southern Fairweather Range.



Oblique View Annette Island from 20,000 feet.

The Alaskan "Panhandle," the area to be photographed, covers about 45,000 square miles, extending from Annette Island in the south to 50 miles north of Yakutat, a distance of 460 nautical miles, with its widest portion approximately 120 miles from east to west. This vast area is of such immense strategic and economic importance to many different government departments which had their own interests and requirements for particular phases of aerial photography. The U. S. Geological Survey required 6-inch vertical photography from a constant altitude of 20,000 feet above sea level for topographic mapping. The Canadian Boundary Commission also needed this vertical photography for determining more specifically the identification and physical location of the International Boundary between Alaska and Canada. Since the U. S. Forest Service desired photography at a much larger scale for timber surveys and evaluations, it became necessary to install sufficient photographic equipment in the aircraft to accomplish photography at scales of both 1:20,000 and 1:40,000. In order that the number of flight lines could be cut down and the overall cost of the photography held at a minimum, two K-17, 12-inch cameras were mounted in tandem, at an angle of 18 degrees from the vertical, to cover laterally the same areas as covered by the single lens of the 6-inch cartographic camera. This precluded the necessity of conducting two flights over the same area.

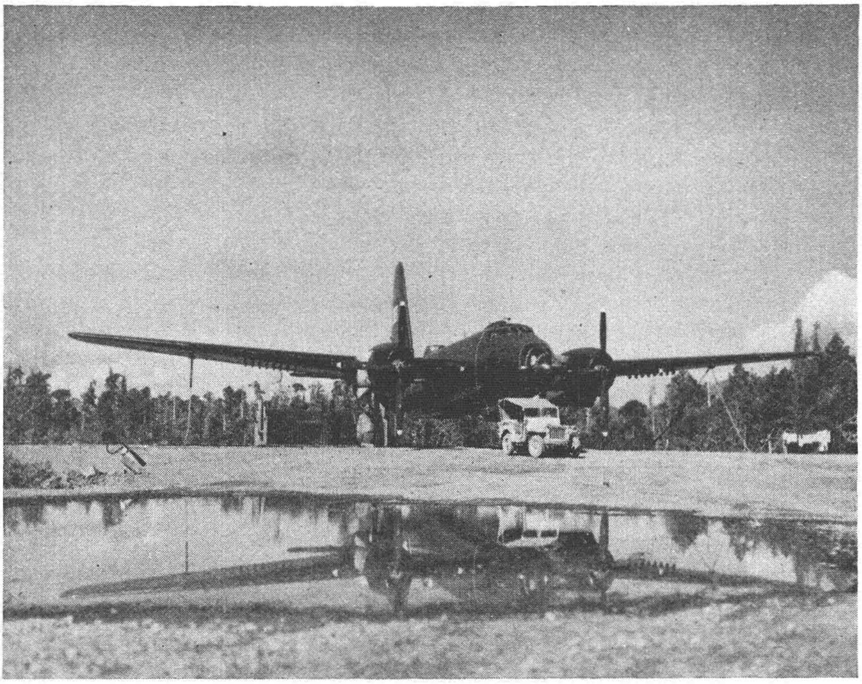
The third type of photography required was low obliques of the many large glaciers in the area for the American Geographical Society for their program of glacier research and study. The K-17, 12-inch camera was employed for this photography.

## GROUND FACILITIES

Of the two major airfields in the Southeastern Alaskan area, Annette and Yakutat, the latter field had the most desirable operational facilities with concrete runways and aprons, more conveniently situated hangar facilities and less hazardous instrument approach conditions. Although Annette airfield had the less desirable conveniences of rough, gravel runways, widely dispersed aircraft parking areas, and wartime buildings in a state of mild disrepair, the more important advantages of local surface logistic support through Ketchikan (20 miles east of Annette) and the smaller air support distance from Whidby Island, Washington, proved to be the governing factors in selecting Annette as an operating base. Periodically, throughout the survey, crews were sent north to operate out of Yakutat for a few days at a time, in the major role of weather reconnaissance.

The USS *Floyd's Bay*, an AVP class tender, later replaced by the USS *Gardiner's Bay*, of the same class, tied up alongside the dock in Tongass Harbor and became the home of the squadron personnel providing messing and berthing facilities. To men and officers who normally view ships only from the air, this living aboard ship in close cramped quarters was an entirely new experience, not altogether enjoyable. Fortunately, there was sufficient room in the photo-lab building to accommodate the photographic personnel for berthing. Although the photographers were required to walk from the photo-lab through a half mile of lush foliage and muskeg to the ship for meals, much time was saved by berthing near their equipment. On the other hand, the flight crews and aircraft maintenance crews were required to travel $2\frac{1}{2}$ miles each way daily to the flight strips. This trip was made by truck. Nevertheless, the transportation situation posed a continuous problem which cut down somewhat on the efficiency of the crews in manning and servicing their aircraft.

As Annette is a stopping place for Pan American Air Lines, the Civil Aero-



P2V in revetment at Annette Island.

Discussing Forest Service Project VP-4 at Photo Lab., Annette Island. Left to right:—C. M. Archbold, U. S. Forest Service; Commander T. F. Pollock, Commanding Officer, VP-4; Frank Heintzleman, Regional Forester, U. S. Forest Service; W. T. Reagan, U. S. Geological Survey; Lieut. (Junior Grade) T. W. Teal, Photogrammetry Officer.

nautics Authority had several buildings and facilities near the airfield which could be made available to the VP-4 personnel. Squadron Operations set up an office in a C.A.A. schoolroom, where preflight briefings were held before each photographic mission. This room was normally used as a schoolroom for the dependents of the station personnel, but, fortunately, for the children and the squadron, it was summer vacation. An adequate briefing room was improvised by consolidating the desks and children's artistic endeavors in the back of the room. The C.A.A. also provided recreation facilities by sharing their local gymnasium with the squadron personnel.

Material stowage was not considered to be an item of particular concern in the original planning or operations, since the tender was assumed to have sufficient space. However, in actual operations, it was soon evident that additional stowage ashore was mandatory, in order to provide shelves for the ready issue of clothing and equipment, safe stowage for extra flight clothing, aircraft spares and automotive parts. Space was also required in which to test and inspect survival equipment, such as rubber boats and life jackets, and office space for administrative personnel concerned with the requisitioning of material and property accountability. Adequate stowage not being available for large structural parts, they were stowed on the line area and covered with tarpaulins for protection from the weather.

## FLYING THE MISSION

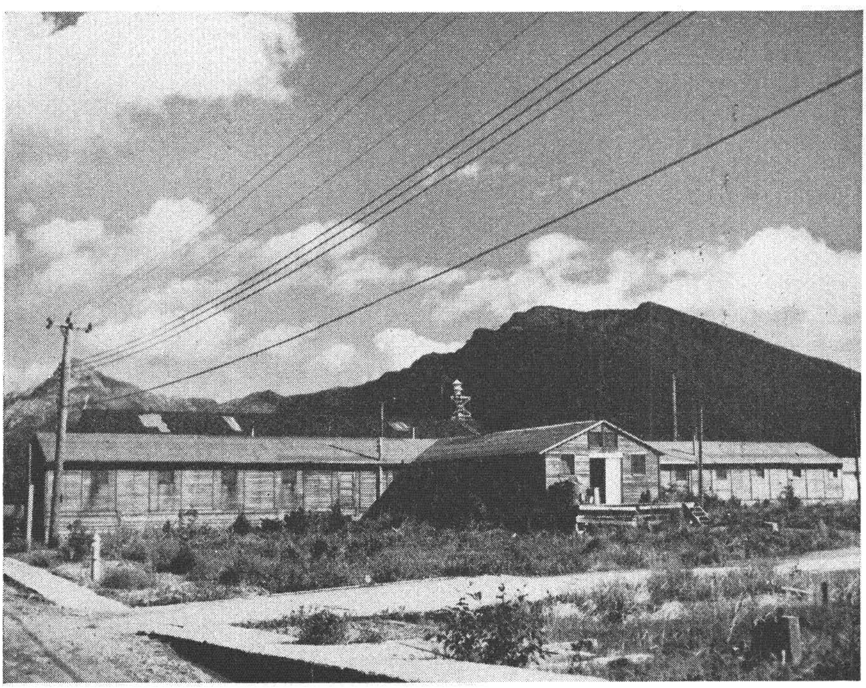
The strange weather conditions prevailing in the Alaskan "Panhandle" were of prime importance in scheduling photographic flights. During the planning stages of this photographic mission, preliminary analysis of the weather in Southeastern Alaska was studied, including both past weather records and future predictions.

The indications for suitable photographic weather during the 1948 season were definitely discouraging. A high frequency of rainfall was expected, and some areas had averaged as few as ten clear days during the summer months. Of these ten days (those with cloud cover of less than one-tenth), not all had necessarily been clear enough for the required photographic standards. Ground fog could be expected in the low channel areas, which, even on clear days, completely obscured coast line delineation. As the season unfolded, it became evident that the weather had once again fooled everyone and belied the gloomy prediction. The favorable photographic weather actually experienced was considerably better than had been anticipated.

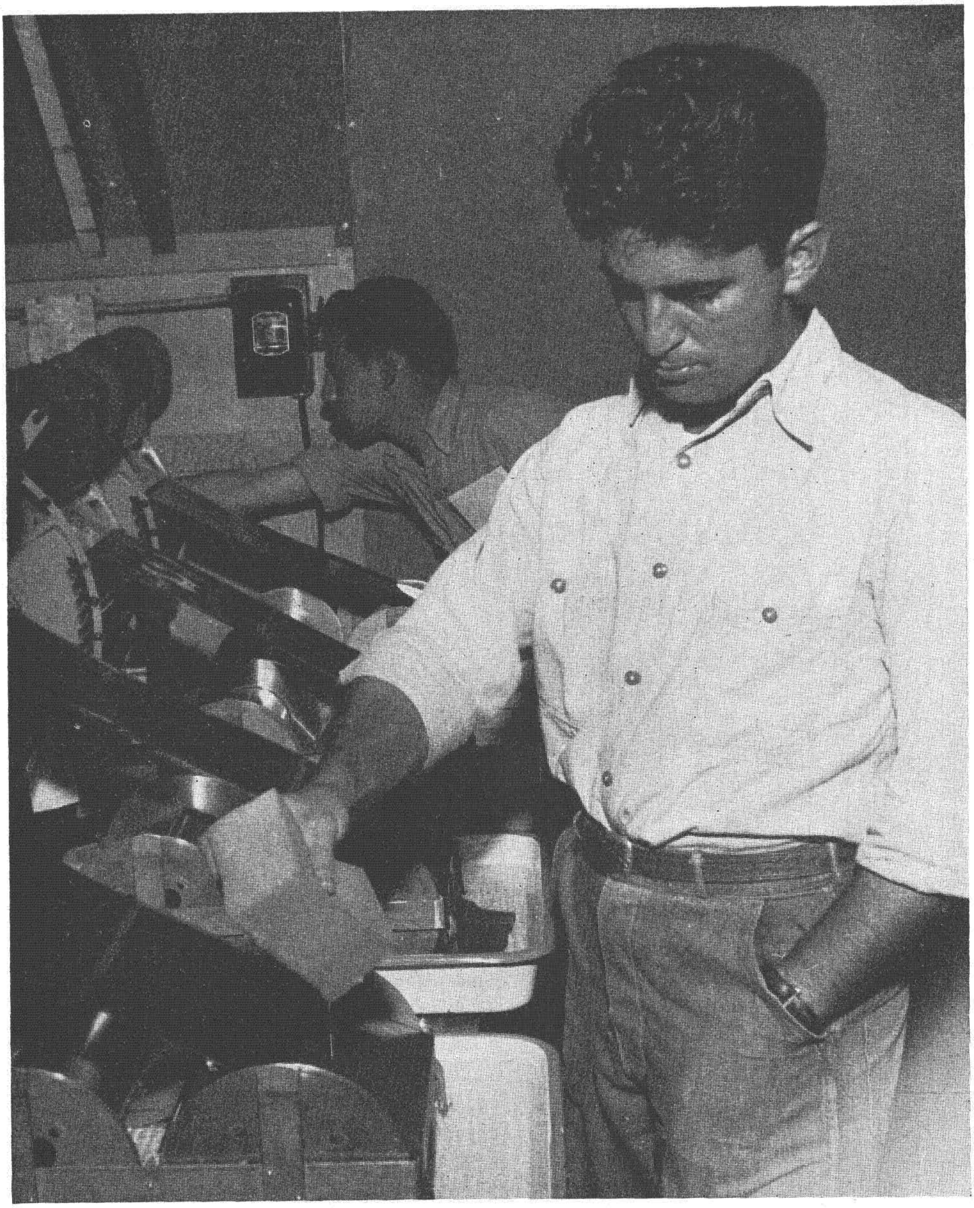
Although the weather was better than had been expected, it was still highly unpredictable. The normal rules of weather did not apply in this area. It was even found that certain areas were clear during a period of falling barometer. On the other hand, forty knots of wind could be howling across the airstrip with the ceiling remaining zero.

With weather stations at Annette, Yakutat, Gustavus, Haines, Juneau, and Petersburg, excellent predictions were expected from the compilation of these data. The negative photographic weather answers received from the various stations provided information for the scheduling of photo missions and saved many a photo flight from becoming merely a sightseeing tour through the clouds. At Annette, the aerological crew prepared four weather maps daily from data copied by radio, Civil Aeronautics teletype circuits, and from half hourly aircraft sequence reports by the airways stations. Considerable professional pride was hurt when certain weather forecasts failed to materialize, though the weather officer was considerably experienced in the Aleutian Area. On several

Checking Sonne Prints, VP-4 Photo Lab., Annette Island. Lcdr. H. L. Donald, Photo Officer; W. T. Reagan, U. S. Geological Survey; Cdr. T. F. Pollock, Commanding Officer VP-4.



VP-4 Photo Lab. at Annette Island.



Film Driers Photo Lab., Annette Island. In rear, E. Ewquivel, AFAN.
In front, N. A. Archey, PH 3.

occasions, photographic weather was found to exist in areas where weather stations did not exist. When borderline conditions approached, the forecasting was supplemented by continuous reconnaissance and surveillance in order to take advantage of every single opportunity to conduct photography.

Prior to take-off on a day's photographic mission, all crews were briefed and assigned an area to photograph by the Photogrammetry Officer. After climbing to the flying altitude of 20,000 feet and arriving in the assigned area, each plane commander would inform the control plane in which the Photogrammetry

Officer served as flight line navigator on which flight line he was commencing, the choice of flight line depending upon local weather conditions. The photogrammetry officer many times directed operations from the bow of his aircraft by VHF radio, much as a field general in tank warfare. By keeping accurate track of each aircraft and the over-all photographic situation, he was able to direct each crew to a new flight line with a maximum of efficiency and the least amount of general confusion.

Each flight line navigator, sitting in his plastic bow compartment forward of the two powerful engines, directed the pilot into the assigned area and onto the approximate heading for the desired flight line, by interphone communication. After establishing his drift by means of the gyro stabilized driftmeter, the navigator set up a wire sight pointing out toward his line of ground check points. When finally approaching the flight line, the navigator assumed rudder control of the aircraft through the auto pilot controls. By this means, the pilot retained control of flying altitude and tilt of the aircraft, while the navigator controlled the direction of flight by making minute corrections in direction of flight, to remain over his check points.

A very fortunate situation was found to exist when it was discovered that the long axis of the islands lay in the same direction as the prevailing winds. With the winds of varying velocity (from no wind to gales of 100 knots), generally blowing from the bow or the tail, very little difficulty was encountered with drift and crab. From the study of normal high-altitude weather conditions in the early planning stages, it was decided to plot the flight lines on the chart parallel to the prevailing winds for ease of flying, and, with the long axis of the islands lying in this direction, flight lines as long as 150 miles were permitted; however, they averaged 82 miles in distance.

Specifications had called for a constant flying altitude of 20,000 feet above sea level regardless of the terrain below. To maintain a proper side overlap under these conditions, it was necessary to vary the flight line spacing according to the elevation of the terrain.

The flight line charts at a scale of 1:250,000 proved to be somewhat unreliable for accurate navigation, due to slight inaccuracies in map planimetry and changes in terrain features since their compilation. In the majority of the cases, poor side overlap was caused by faulty maps, rather than by poor flight line navigational technique. A postflight check of the Sonne printed strips showed many cases where the navigator had passed over every check point indicated on the map, but, due to terrain feature displacement, the lines were not straight and the side overlap fell off.

Even more confusing were those large blank areas marked "Unsurveyed" on the maps. With absolutely no terrain features indicated on these areas, it was impossible to navigate the flight lines entirely by reference to physical check points. In these cases, cross-flights were photographed and new flight lines established on the prints for use of the navigators.

Although the outside air temperature of that area at 20,000 feet was around −25° Centigrade, the plastic nose allowed the sun to heat the flight line navigator's compartment sufficiently to allow him to conduct his flight with no more cold weather clothing than a summer flying jacket over his nylon flight suit. On the other hand, the aerial photographers bending over their cameras for hours on end found that it took considerably more clothing to keep them warm. After several photographers experienced frostbite, it became general practice for them to wear electrically heated flying boots.

Since the fore and aft coverage of the split 12-inch cameras was just half

Forestry Project Room, VP-4 Photo Lab., Annette Island. Left to right:—P. A. Rivet, AA; G. G. Francis, SN; I. B. Feinberg, AF2; Lt. J.G. T. W. Teal; D. I. McCrae, ADAN.

Skagway

that of the 6-inch vertical camera, it was necessary to use an automatic hand switch which electrically operated both types simultaneously. The photographer, peering into his viewfinder, actuated the hand switch at the time of proper forward overlap for the 12-inch cameras only. The switch was constructed so that it made electrical contact with the 6-inch camera on alternate strodes only; therefore, the proper forward overlap was achieved for that camera at the same time. Unfortunately, this switch, designed by one of the photographers to operate mechanically, was altered by the manufacturer into an electrical micro-switch mechanism. The electrical contacts soon failed, causing many camera failures and much loss of valuable film.

The photographers had been accustomed to determining their forward overlap by means of a K-17, 6-inch camera with a ground glass back which showed them the entire field of view covered by the camera actually taking the pictures. Because of the unavailability of spare 6-inch cameras, Patrol Squadron FOUR was forced to use the standard 10-inch viewfinder, showing only a portion of the full view as seen by the 6-inch camera. When approaching high mountains, which rose abruptly out of the sea, the photographers found that the ground movement in the viewfinder increased so rapidly that they lost their correct forward overlap before they realized it. It became general practice for the navigators to give advance notice of any sudden changes in approaching terrain, but even that at times was of no avail, for the terrain varies considerably from low timber covered islands to glacier covered mountain ranges with altitude changes of as much as 10,000 feet within fifteen miles. The necessity of flying over Mount St. Elias (elevation 18,000 ft.) at an altitude of 20,000 feet above sea level with only 2,000 feet clearance is also not conducive to good photographic coverage.

In the original planning, an aircraft availability of from 50% to 60% was estimated. This should have allowed the non-flying photographers to handle quite efficiently the processing of the film from the operating aircraft. Due to the untiring efforts of the maintenance crews, a record availability of 90% was maintained throughout the season; hence, adequate laboratory personnel were available, but at no time was the lab entirely caught up in its work. It had been planned to rotate two of the three photographers in a flight crew daily while the other did the lab work. Since the ground processing continued on into the night, a lab man working late would get insufficient rest for his next day's turn at the camera in the air. A ten hour stretch at 20,000 feet on oxygen is no easy job, and it began to tell on the men working both on the ground and in the air. After operational fatigue caused a few major photographic errors in flight, it became necessary to limit the lab work to men who were not expected to fly. Since no rotation was possible for the pilots or the flight-line navigators, they were required to make all flights.

Regulations required periodic 30-hour, 60-hour, and 90-hour aircraft maintenance checks. The successful completion of the photographic mission required that all aircraft be in the air at every time possible. In order to accomplish both of these requirements, it became necessary to hold all maintenance checks at night, for the planes to be ready to roll again by the next morning. Normal photographic flying operations put sufficient hours on the aircraft to require two 30-hour checks to be completed each night.

Fortunately, on photographic days, the rain was lighter but not necessarily completely absent. In June and the latter part of August and September, rain occurred on over 50% of the days. Working in chilling rain in the dark is not particularly efficient, but one assisting factor was the long periods of daylight.

Actual darkness occurred as late as 10:30 P.M. in midsummer with daylight beginning around 2:30 A.M.

Near the end of the photographic season when the successful completion of all high altitude mapping photography was imminent, the task of photographing the spectacular glaciers in the Southeastern Alaskan area was commenced. It did not take long for the crews attempting glacier photography to realize that they had no conception of what the American Geographical Society desired in a portrait of a glacier. The A.G.S. was then contacted for further instructions. It was then discovered that principally the details of the terminus of the glacier was desired rather than an over-all view. Further requirements were data on the direction of view of each photograph, the altitude of the aircraft, and the exact geographical position of the aircraft when the picture was taken. This latter was somewhat of a problem at the relatively low altitude at which this photography was accomplished. When flying up a valley between two high mountain ranges, concentrating on a glacier, it was rather difficult to estimate the exact position of the plane.

This low altitude oblique photography required further photographic configuration of the P2V-2 with the removal of the liferaft hatch prior to leaving the ground. The photographer then had sufficient space to swing his camera freely in all directions, but it also let in a terrific blast of cold air. However, the relatively low altitude required by this glacier photography did not generally lead to the extremely cold outside air temperatures that existed at 20,000 feet.

In addition to the liferaft, many items of an emergency nature were carried in each plane on all mapping flights in the event of a forced landing in the wilderness. These included a bedroll for each crew member, a trench shovel, an M-1 30-caliber rifle, and a 12 gauge automatic shotgun stowed in each plane. Fortunately, none of these were ever required for survival.

## LABORATORY OPERATIONS

The main difficulty encountered in processing the photography lay in the fact that three separate missions were involved. Each mission required a different type of photography, with different sets of specifications to be met. To keep the situation from descending into utter confusion, the processing was completely separated into its three main components: (1) 12-inch Forest Service photography, (2) 6-inch Geological Survey photography, and (3) the American Geographical Society oblique glacier photography. After developing the film rolls in the Morse developing tanks, each roll was strip-printed in the Sonne printing machine for checking purposes. After the rolls had been checked for proper photo coverage, they were marked and checked on a line index of the area. The record of two complete sets of contact prints delivered to the Forest Service from the field laboratory stands as an outstanding accomplishment of the Navy photographers. Seldom is an advanced base aerial survey unit expected or required to accomplish such a major photographic task as printing 50,000 aerial photographs under the hardships of a primitive field laboratory. This permitted the entire Forest Service project to be completed and delivered before the squadron departed from Annette Island at the close of the photographic season. The glacier photography also was completely printed, and the prints and negatives delivered from the field. The remainder of the printing and indexing was deferred until the return of the film to the Fleet Photographic Laboratory at San Diego for final printing for the Geological Survey Department.

At the close of the 1948 photographic season, the tally showed 1,260 hours of flight time, 23,000 linear miles of flight lines, and the successful completion of the assigned survey of Southeastern Alaska. Thus, in one season a gigantic project, planned to extend into three separate photographic seasons, was completed by United States Navy Air Force, Patrol Squadron FOUR which had never before used an aerial camera.

# A STANDARDIZED TONE SCALE AS AN AID IN PHOTO INTERPRETATION

*Robert E. Daehn, Editorial Assistant, A. J. Nystrom & Co.*

IN dealing with stereo vision of aerial photographs, whether as photo interpreter or photogrammetrist, a recognition key is held to be of paramount value. The key is usually made up of six fundamental factors: tone; texture; pattern; distribution; stereo appearance; and specific types. All of these factors excepting tone can be dealt with in concrete terminology. In the past, tone has been classified by words of such variable meaning as dark, medium or light. It is

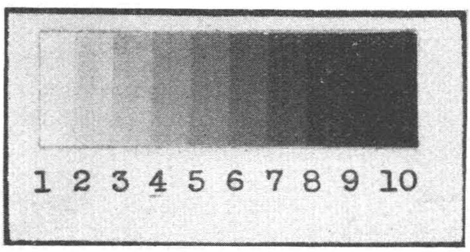



FIG. 1. Standard numbering from 1 to 10, progressing from white (1) to black (10).

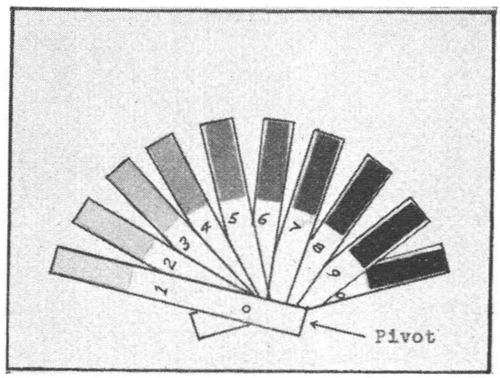



FIG. 2. Refinement of principle for use under a stereoscope.

obvious that what might be medium tone to one observer would not necessarily be so considered by a second observer.

By the substitution of the standard gray tone scale,[1] with numerical values of from one to ten, the haphazard guess work may be removed from tone classification. The author has used with success a contact print of a standard negative exposure guide found in most home darkrooms and procurable at a nominal cost from any good photo equipment dealer. Figure 1 shows such a print with the standard numbering from 1 to 10 progressing from white (1) to black (10).

A refinement of the above principle for use under a stereoscope is shown in figure 2. If the ten degrees of tone quality are cut apart and mounted on separate strips of light cardboard, comparison under a stereoscope is facilitated. If the ends are mounted on a pivot, such as a brass paper fastened, a handy tool is ever present that should become standard equipment with the aerial photo interpreter.

[1] TM 5-245 Map Reproduction in the Field, U. S. Government Printing Office, May 1946, pages 59 and 62.