MAPPING IN THE SOLOMON ISLANDS

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Introduction

THE history of the Solomon Islands has been characterized by strife, location, climate, topography, disease, and native hostility united to create conditions least favorable for large-scale colonization. The group consists of 13 large islands, 13 smaller ones, and many hundreds of islets, all of which are arranged in a double row more than 600 miles long. Although the major land areas measure 15,000 square miles, prior to present hostilities they were inhabited, and almost entirely on the coastal fringe, by less than 500 Europeans. As a result, the Solomons, though one of the largest groups in the Pacific, was one of the least known and developed.

The southern Solomons were declared a British Protectorate in 1893. In 1900 Santa Isabel, Choiseul, and the islands south of Bougainville Strait were transferred from Germany to Great Britain by treaty. Buka and Bougainville, once part of the German New Guinea Protectorate, were occupied by Australian troops in 1914 and were incorporated in the British Mandated Territory of New Guinea.

At the outbreak of war in 1939 regular steamer communication was maintained only once every five and one-half weeks between Sydney and the Protectorate. Auxiliary vessels, inter-island schooners, and itinerant steamers furnished internal communication and offered occasional egress to cosmopolitan ports.

Most of the surveys of the group had been made by the British and Germans prior to 1900; coast lines of major islands were only approximated, many reefs were uncharted, and small islands were misrepresented in size, shape, and position. Corrective surveys had not been required for daylight navigation by small craft. This resulted in chart notes to the effect that "it is reported to be 5 to 10 miles further east." Large scale charts were largely non-existent, and small scale charts were inaccurate and completely inadequate for navigating major naval units. In the whole group only the fixes at Tulagi and Cocoanut Island, off Faisi Island, were considered reliable.

Against great odds, in these constricted, reef-infested, completely foreign straits and passages, United States Naval Task Forces successfully fought the most vicious night actions in history. The remarkable navigation, without which these victories were impossible, may be attributed to courage, superb seamanship, and technologic developments.

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The enemy's southward encroachment had stemmed from the capture of the unfortified (by the League of Nations Mandate of 1920) but vitally strategic base of Rabaul in January 1942. The northern Solomons were occupied without opposition and enemy bases were established on Buka, Bougainville, Ballale, Shortland and Santa Isabel Islands. After the Battle of the Coral Sea, the Japanese started to build an airstrip at Lunga Point on Guadalcanal Island and began to fortify and prepare Tulagi for a fleet anchorage and seaplane base. It became obvious that without immediate action the already attenuated Allied supply line would be cut. This prompted landings, which were made with only uncontrolled overlays, sketches, and antedated H.O. Charts, at Guadalcanal and Tulagi in August.

As the campaign fanned out from Lunga Point there came a concomitant

demand for maps. Although there were no photographic squadrons in the theater, Army B17's (Fortresses), equipped with a single camera hatch, were pressed into service manned with Navy and Marine photographic personnel. These aircraft, based at Espiritu Santo and staged from Henderson Field, flew photographic sorties of Guadalcanal and enemy positions in the northern Solomons in addition to their regular bombardment missions. These were the first photographs taken in the South Pacific suitable for stereoscopic interpretation or cartographic construction.

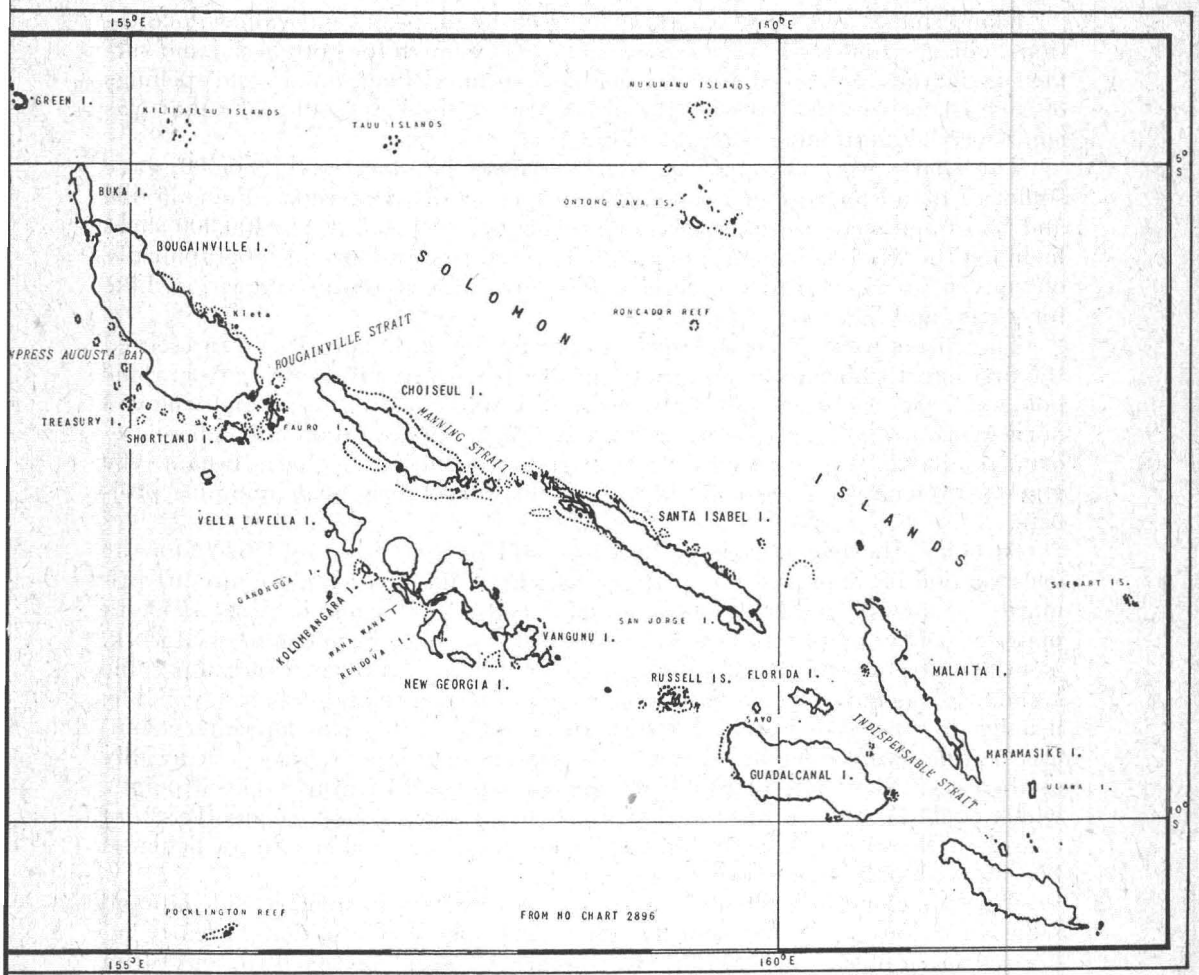
During these months, also, the Marines had an F4F-7 (Wildcat) modification based at Henderson Field. This aircraft flew tactical photographic missions along the terraced coastal strip of Guadalcanal and occasionally covered various parts of adjacent islands. In addition, a number of oblique sorties were flown by a Marine SBD (Dauntless) squadron also based at Henderson Field.

Although overlays and mosaics were made from these runs, hasty terrain maps at 1/20,000 were, for the most part, finished after the end of the campaign. Therefore, their chief use was in the development of the island as an Allied base. The units which compiled these sheets used radial line method, or slotted templet adaptation, for horizontal photographic control and stereocomparators for elevation determinations. Preliminary ground surveys served as the basis for extension of control.

With the realization that aerial photography and photographic interpretation had been responsible for most of the intelligence data, Army, Navy, and Marine photographic units were brought to the theater. These squadrons had been trained for tactical as well as mapping missions and were equipped with aircraft admirably adapted for photographic flights. Cameras suitable for any mission from tri-metrogon mapping and interpretative coverage at 35,000 feet to dicing runs were available. Three became almost standard for both verticals and obliques: the K17, K18, and F56. The K17 was equipped with a magazine that contained 150 9″×9″ exposures and with 6″, 12″ or 24″ cones. The 12″ focal length was the best mapping lens because it gave, at desirable scales, maximum coverage with minimum distortion. The tri-metrogon installation consisted of 3 6″ K17's, all operating from a single intervalometer, with the oblique cameras' optical axes at approximately 60° to vertical. The K18 was essentially an interpretative camera. It was equipped with a 24″ lens and a magazine which contained 45 9″×18″ exposures. The F56 was used for high altitude large scale work or obliques; 8¼″, 20″ or 40″ cones were available and the magazine contained 100 7″×7″ exposures.

An Army squadron was equipped with P38s (Lightnings), which modified for photography, were called F5As. A tri-metrogon installation and one K18, or combinations of K18s and K17s, were mounted in the nose. They were not rigged for ordinary obliques. The F5A's speed, ceiling, range and durability made it an ideal one-man photographic plane. They were used essentially for tactical missions, and, weather permitting, they covered each Japanese base daily. The intelligence value of these photographs day after day, month after month, cannot be overestimated.

The Navy and Marine squadrons used PB4Ys (Liberators). Four vertical camera mounts were installed in the bomb bay. Cameras, range, and ceiling made these squadrons highly versatile. They operated singly or in groups depending upon the mission; fighters were used occasionally for cover when the target was within their restricted range. Ceiling and fire power, however, made PB4Ys in formation capable of 2,000 mile missions over the strongest enemy bases. Possibilities of fighter interception and weight and accuracy of AA usually



determined flight altitude. On purely tactical missions a frequent camera combination was 2 K18s—24″, 1 K17—6″, 1 K18 or K17—24″ or 12″ color or infrared or an F56—40″, and obliques from the waist hatches. On mapping sorties combinations of K17s and K18s were used. Enemy opposition and the ultimate scale of the map or chart to be constructed controlled the altitude and cones.

The first important mapping mission was the tri-metrogon coverage of the group. This was made by F5As at high altitude and was used in the construction of the Army Air Forces Charts. In these charts secondary, or photographic, control consisted of radial line extension and routine oblique restitution. After compilation of photographic detail to this control, land and reef areas were adjusted as reasonably as possible to what was considered the best ground control gathered from all available charts, navigational, and intelligence sources. Although reconnaissance parties were landed several times in enemy territory to obtain fixes on critical points, these charts showed shapes much more accurately than absolute positions, bearings, or distances because of excessive tip tilt. Lacunae also resulted from steep declivities on a few islands well out on the obliques. Yet errors on these charts were insignificant by comparison with those of the H.O. Charts.

Island shapes and sizes, coastline and reef detail, peaks and valleys, plantations, villages, and trails were shown accurately enough for both aerial and surface navigators to proceed with reasonable assurance. Place names and spellings of each island were edited with the aid of former residents and much that was controversial and ambiguous was eliminated.

The charts were produced at several scales. The largest, 1/250,000, gave sufficient detail for reconnaissance and surface navigation. Buka, Bougainville and Shortland were also issued on one sheet at 1/500,000. A 1/2,400,000 sheet included the whole Solomon group. All charts were reproduced lithographically on convenient sized sheets in three colors; green for land and vegetation, blue for water, and black for culture.

The charts were given widespread distribution and, since they represented the first effort to bring the group into proper perspective from the cartographic point of view, their use and worth were invaluable. As the campaigns moved northwestward and more information, large scale maps, and ground control became available, new editions were issued. As a result these charts became the standard reference: a great aid in the compilation of large scale mapping projects.

Although the coastal strip of Guadalcanal had been flown by PB4Ys for the construction of maps and mosaics, the first large misison by these aircraft primarily for mapping was the coverage of the Russell Islands in April 1943. In mapping sorties preparations were similar to those followed in commercial work. Yet difficulties encountered in flying were such that maintenance of comparable standards was impossible. Flight lines were plotted on the best charts available, usually the Army Air Forces charts; allowing 40% to 50% side lap; intervalometer settings were calculated for 60% minimum over lap. Navigators carefully studied each flight line and picked prominent physical features, check points, which could be used for orientation. In flight the bomb sight frequently was of considerable aid in getting on line. Once on, the run was flown on a calculated bearing with only minor corrections.

Tilt, tip, cloud interference, incomplete coverage or insufficient side lap and scale variations resulting from atmospheric pressure fluctuations, greatly increased the problems of mapping. In commercial work combined tip and tilt in excess of 3° is ample cause for rejection; clouds or incomplete coverage are eliminated merely by reflying the lines, and altitude variations are either easily corrected or compensated. But in combat areas, because of excessive risks to personnel and aircraft, mapping runs are considered satisfactory if coverage is complete. This obviously means that the variables must be rectified by the photogrammetrist.

Tip and tilt in considerable amounts are the rule rather than the exception in combat flying, and under adverse conditions may be extreme; it was frequently necessary to use prints that were 5° or more from vertical. These variations resulted from the turbulent condition of the air found in the tropics over mountainous terrain, particularly when a partial cumulous cloud cover was encountered, and from the inherent difficulties encountered in immediately correcting a wing "falling off" on an aircraft the size of a PB4Y. Naturally, mechanical difficulties encountered in formation flying, mental strain involved in possible or imminent enemy interception, and turbulence caused by AA all were contributory factors. (The F5As, in addition to severe tilt, frequently had a constant tip factor in their runs. This resulted from the fact that the cameras were fixed and the altitude of the aircraft changed as the fuel supply was exhausted.)

Although cameras were equipped with bulls-eye level bubbles for making the necessary adjustments immediately before exposure, in most instances the photographer was unable to make this correction. Because the four vertical cameras were installed in line in the bombbay and because only one photographer could work along the narrow cat walk which serviced these, his time was devoted largely to checking camera operations and changing magazines. Thus, for the most part, tip and tilt reflected the actual deviation of the aircraft from the horizontal at the instant of exposure of the various elements.

Clouds were perhaps more troublesome and led to more errors than tip and tilt. Missions were scheduled on meteorological forecasts; .2 cloud cover—good, .3—fair, .4—poor and .5—unsatisfactory. Tropic land areas, particularly those of some altitude, are usually capped by a plume of clouds. In early morning, before the sea breeze begins, cloud cover is lightest. These early hours, however, are less satisfactory from the photographic standpoint because of long shadows. Missions, therefore, were planned so that the target would be reached after 0900. By this time cumulus clouds had usually started to build up and by noon the cloud bases frequently had begun to expand. These considerations seriously limited the hours of photography on favorably forecasted days. During the rainy monsoon, missions were infrequent and the poor quality of coverage made mapping increasingly difficult.

Incomplete coverage or insufficient side lap was usually caused by clouds which obscured navigation check points, by inaccuracies in scale and bearing of charts used for plotting flight lines, or by pilot and navigator error. Some of the islands in the group were off as much as 10 miles in width or length, and 15° in bearing. Since flight lines were flown on calculated bearings or reciprocals, inaccurate charts resulted in omissions or necessitated corrections after the run had been started. These corrections, when attempted, not only led to confusion in formation flying, but also increased tip and tilt.

Altimeters were corrected for the atmospheric pressure of the air strip from which the sortie was flown. Since there was no ground control, it was necessary to calculate scales from the altitude-focal length relationship. Thus, undetected large pressure differentials that frequently occurred on 500- and 1,000-mile missions resulted in concomitant altitude fluctuations which could be rectified only on the basis of incomplete weather data.

For several months after the coverage of the Russell Islands, mapping missions in the central and northern Solomons were extremely hazardous because of the concentration of enemy air strength. None the less, the coast of Rendova, the western part of New Georgia, Blackett Strait, and parts of Santa Isabel, including the Rekata Bay area, were flown. (Although several semi-controlled sheets were compiled from these coverages, for the most part uncontrolled overlays and mosaics were made. Some of these were form lined from stereocomparator elevations.) Gridded uncontrolled photo maps constructed from these runs, however, subsequently proved unsatisfactory for fire control because scale variation resulting from the considerable relief, tip and tilt did not permit determination of a constant K factor (scale variant).

In June Wana Wana and Arundel Islands were flown by PB4Ys. Because the islands were considered of secondary importance, only single color uncontrolled maps at 1/20,000 were made. Stereocomparator elevations were used in formlining the few hilly sections at an 100′ (approximate) interval.

Kolombangara Island was flown for mapping in July 1943. The island is a symmetrical volcanic cone about 20 miles in diameter at the waterline. It rises to approximately 5,500 feet, and is capped by an almost vertical walled crater

several miles wide. On the southeast side the rim has been breached by a canyon over 1,000 feet deep, resulting from crater overflow and headward erosion of the Vila river. The island has an idealized radial drainage pattern, interrupted only by a few parasitic cones, and is covered by dense jungle except for several plantations on the coastal fringe. The coast line had been quite accurately charted and elevations determined for a number of high points on the rim and several small cones.

Semi-controlled mapping had not been attempted for whole islands of such size or ruggedness; only small sections of major islands had been mapped and these failed to furnish an adequate check, either vertically or horizontally. It was tacitly assumed that major scale changes resulting from large elevation differentials would be satisfactorily eliminated. The major concern hinged on whether or not tip and tilt adjustments would be adequate to check out runs and known elevations and afford reasonably accurate formlining.

The island was flown by one PB4Y on a nearly cloudless day. Altitude was carefully maintained, probably well within $\pm 100'$, and flight lines were excellent. Fourteen runs were made with K17-12″ and K17-6″. Prints were made on waterproof map paper to minimize differential stretching and shrinking. Routine radial line procedure was followed in picking and transferring center and wing points on the 12″ runs. Special care was used in choosing topographic points: coast line detail, important river confluences, all peaks and cones, and any feature that might be useful for orientation, either by inspection or resection.

The absence of ground control necessitated the assumption that, provided the flight level were constant and tip and tilt not excessive, beach topographic points would fall one upon the other around the island if the scale variables had been removed. Since the scales were $\frac{1}{4}$ to $\frac{1}{3}$ greater in the center than at the water line it was evident that the adjustment would require considerable inward movement in the central section. After the templets had been prepared and slotted, which included some 2,000 points on slightly less than 200 templets, the assemblage was started at the waterline. The south half laid down satisfactorily, but as the center was approached beach points began to spread, indicating insufficient takeup. The error increased, and since the templet paper was not sufficiently slick to allow adequate adjustment, it was necessary to start over. On the second try the coast line sections were kept slightly ahead of the center and the island laid down satisfactorily; beach points fell upon each other throughout and the central adjustment was reasonable. The calculated scale was approximately 1/40th greater than that of the H.O. Chart.

In determining stereocomparator elevations experience had shown that tip and tilt could be adjusted best when small scale prints were used; a stereopair then showed more area which permitted a better general terrain study. It must be remembered that there was no vertical ground control; it was therefore necessary to start at sea level and return to sea level to obtain a check. This, at best, afforded only a poor test because combined tip and tilt should be compensatory if the flight line is straight and the altitude constant. Since accuracy depended largely upon the judgment of the stereocomparator operator, which was contingent upon his knowledge of land forms and stream profiles, men who had been trained in geology and geomorphology were most reliable. In the Solomons, volcanic islands flanked by terrace deposits and coral limestone, stream profiles furnished the best check; physical characteristics of a river valley enable a much closer estimate of the height above sea level than those of a mountain peak. Thus, by dividing an island into sections bounded by major streams, it was possible to return frequently to an estimated elevation. Obviously, small

scale pictures reduced the number of stereopairs involved for each check point.

In the 6″ focal length four flight lines covered the island. These were worked with a stereocomparator from each side of the island to check points on the rim. The runs were started, as were all runs in which ground control was unavailable, by removing the tilt (deviation from the horizontal about the axis parallel to the line of flight) from the stereopair by minute rotation of the prints in the horizontal plane until the floating marks zeroed at both ends of a line which cut the coast orthogonally to the stereoscopic base. After the tilt had been removed, and so long as the coast could be reached by a line at right angles to the stereoscopic base, the instrument could be zeroed and the terrain worked along this line, thereby also removing the effect of tip (deviation from the horizontal about the axis orthogonal to the line of flight.) This system was used because it was faster than calculating and applying a component and rate of combined tip and tilt, and because it was considered within the anticipated attained accuracy. Elevations were carried from one stereopair to the next, and since the tilt was theoretically removed from all stereopairs, tip was the critical variable. Of the eight runs carried to the top of Kolombangara, five checked the elevation to within 100′, and three were off from 700–1400′. These major discrepancies proved the fallacy of attempting to formline directly from unadjusted stereocomparator elevations. Obviously, when formlines were carried to adjacent runs, such elevation differentials would introduce large topographic features that were non-existent. None the less, with five runs checking, it was possible to adjust the spot elevations and arrive at a reasonable picture. Spot elevations, however, were not changed on the prints because of the time incurred and possibility of damaging the emulsion. Instead, all prints were worked by one man at which time only the "control" form lines, the 500′ and 1,000′, were sketched. These were adjusted to the erroneous runs by mentally correcting the elevation differentials. This system resulted in each 500′ form line being a closed traverse since each was worked all around the island. Care was used to insure that stream gradients and ridge declivities were presented in a sound geomorphologic manner. The control form lines were transferred from the 6″ focal length prints to the 12″ focal length prints which were used for compilation to the master sheets. Then the 100′ form lines were sketched between the control lines.

This system, though obviously an expedient, undoubtedly resulted in the greatest overall precision. Ground operations were concerned more with slopes likely to be encountered and proper configuration of land forms than with absolute elevations. Although it was difficult to estimate the accuracy of elevations indicated by formlines, it was considered that maximum error was probably within 10%. Subsequent artillery fire, based on the heights of several parasitic cones, disclosed that those particular features were within these limits.

In August, Vella Lavella Island was flown for mapping. Because of a medium level cloud cover it was necessary to decrease the scheduled altitude and use a 6″ lens. The proximity of Kahili airfield on Bougainville Island also required that it be flown in formation with a fighter cover. These factors, combined with a 10° discrepancy in overall bearing of the island, resulted in excessive tip and tilt on some runs, which, together with the inherent distortion found in a 6″ cone and cloud cover on the higher peaks, resulted in unusual difficulty in maintaining satisfactory horizontal and vertical control.

Tip and tilt were so severe that stereopsis could not be maintained over the whole stereopair with the instrument parallel to the stereoscopic base line. An expedient which eliminated setting up prints two or three times entailed working each pair to the limit of stereopsis and then changing instrument angle until

stereopsis was obtained on the adjoining section. By comparing parallactic measurements before and after the stereocomparator angle had been changed it was possible to determine the correction which was to be applied to succeeding measurements.

In spite of these difficulties a templet assemblage of over 200 prints was made in which it was necessary to discard only relatively few points. Since the Oula River roughly divides the island in half, control form lines at an approximate 500′ interval were sketched around these two sections. Because the island was flown at only one scale, these were necessarily worked on the prints that were compiled. This made possible a comparison with the routine followed on Kolombangara Island in which control formlines were sketched on smaller scale prints and transferred to the compilation set. It was found that the Kolombangara system required less time and was probably more accurate. The Vella Lavella work definitely proved, however, that prints involving so much tip and tilt could not be formlined at an estimated interval unless the control formlines were first obtained.

The finished master sheet required twenty four 17″×19″ sheets at 1/20,000 to cover the island. Color separation was, as in all maps produced in the area, made by the draftsmen from the master sheet. Each sheet was shown in three colors; black for cultural and water features, brown for formlines, and green for vegetation. Reproduction was by offset press.

In September hasty terrain maps were made of the Treasury Island Group from F5A coverage. Radial line control was used and compilation was essentially the same as that for Vella Lavella and Kolombanagra Islands. Blue was used, however, as the water symbol. Only parts of 3 sheets were required to include both Mono and Sterling Islands which comprise the group.

The same coverage was also used for constructing a semi-controlled mosaic. Because of the time factor, prints were not restituted, but were laid to the same control as the hasty terrain maps by making the best overall adjustment to control points. Although interruption of detail at feather edges was considerable when topographic displacement or tip and tilt were excessive, scale was constant enough that the 1,000 yard grid could be applied with reasonable coincidence. Sheet distribution was the same as used for the hasty terrain maps and reproduction was by offset press at the same scale. They were entitled Photo Maps and were a valuable adjunct.

The same month hasty terrain maps of Empress August Bay on Bougainville Island were constructed from F5A coverage. Photo Maps, covering identical areas, were also compiled to the same control. Most of the sheets covered the low lying coastal area which was crossed by a number of large anastomosing streams. These furnished frequent checks for vertical control.

Scale was calculated from altitude-focal length relationship and coordinates were derived from the best available information. Very shortly before the landings, however, submarine reconnaissance indicated that there was a discrepancy of over two miles in the position of Torokina Point. Although it was possible to disseminate these data to the surface forces before D day, ground troops had to use the uncorrected maps. As soon as astronomical observations had been made, a new edition, which embodied the corrected coordinates and grids, was issued.

Although navigational information of surface vessels and submarines had long been incorporated in charts, the great value of the Torokina observation led to utilizing submarines, when operations warranted, purely for tactical reconnaissance. On these sorties cuts were taken on critical islands or points from several positions immediately before or after a reliable astronomic fix had

been obtained. These data were plotted against photographic detail, thereby determining the best orientation.

The northern half of Choiseul Island was flown for mapping by PB4Ys in October. Hasty terrain maps at 1/20,000 were made with slotted templet control. A fix had been obtained at Choiseul Bay by ground reconnaissance several months earlier so the position was not in question. Vertical control problems were simplified by several large rivers at right angles to the major axis of the island. Fourteen sheets, reproduced by offset press in three colors, were required to cover that section of the island.

In the latter part of October the first semi-controlled chart for naval fire control was constructed. Prior to this, shore bombardments had been conducted with overlays or uncontrolled mosaics of various scales. Where the targets lay close to the shoreline this procedure was satisfactory. If,however, a considerable area were taken under bombardment some distance from the ranging salvo check point, variations in scale would result in attending inaccuracies in fire.

Eight F5A runs, all of which crossed Buka Passage at different bearings, were used in the slotted templet assemblage. Form lines were sketched from stereocomparator elevations at a 100′ interval (approximate). Coordinates were from the Army Air Force Charts, and a local 500 yard grid was superimposed. All island and reef outlines, roads, plantations, villages, and form lines were shown in black. Targets, which included air strips, defense installations, stores and bivouac areas, were outlined, assigned priority by photographic interpreters, and overprinted in magenta. Reproduction was by offset press at a scale of 1″ = 500 yards (1/18,000), a convenient scale for fire control plot.

Of the cartography in the Solomons, all of which was done under pressure, the Buka Passage charts were completed in record time; slotted templet control, stereo comparagraph elevations, formlining, compiling and final drafting of 6 19″×22″ sheets were completed in three days. This, in spite of the fact that picking control points was particularly slow and onerous because runs not intended for mapping were used.

Night shore bombardments require a special technique in which the navigator continuously furnishes the gunnery officer ranges and bearings to a reference point of fire. Observations showed that best results could be obtained if the navigator and gunnery officer had charts constructed from the same base. Since fire control charts varied in scale from 1″ = 250 yards (1/9,000) to 1″ = 1,000 yards (1/36,000), depending upon the fleet units for which they were designed, it is obvious that comparable scales for the navigator would result in charts too cumbersome for use because the bombardment course usually varied from 10,000 yards to 30,000 yards off shore. Further, the navigator required a chart which embodied the whole coast line, particularly the target approach, so that the ship's position could be accurately determined before ranging salvos were fired. It was necessary that form lines, major roads, plantations, and villages be shown for the charts to be suitable for surface and air spotting. In order to show this detail legibly and have a chart satisfactory for surface navigation and aerial reconnaissance, the convenient scale of 1″ to one nautical mile (1/72,960) was chosen.

These charts were called "Combat Navigation Charts" and followed the general format of an H.O. Chart. They were controlled by slotted templet, and form lines were sketched from adjusted stereocomparator elevations. H.O. Chart soundings and all navigational aids were incorporated. Coordinates were obtained from the best available navigational data. The charts were printed in black with land areas over-printed in a light gray tone. Plantations, villages,

and roads were shown by standard symbols. Distribution was made to air and ground units, as well as surface units.

In early November the Shortland-Faisi-Poporang-Ballale Group was flown by PB4Ys with 6″, 12″ and 24″ cones. A combat navigation chart was constructed from 6″ focal length prints the scale of which made possible reasonable accurate ties between islands. The fix at Cocoanut Island, immediately north of Faisi Island, gave accurate position. The chart was reproduced on an 18″×24″ sheet by offset press.

Buka Island and the north part of Bougainville Island were flown for mapping by PB4Ys with 6″, 12″ and 24″ cones. Combat navigation charts were constructed following the pattern set by the Shortland Group. Since the area covered was approximately 25×50 miles the charts were issued on two 22″×29″ sheets.

Hasty terrain sheets were also compiled in November covering the Kieta area of east Bougainville Island. These were at the standard 1/20,000 scale and were reproduced by offset press in four colors.

In mid-November the central two thirds of Bougainville Island was flown by PB4Ys with a 12″ cone. This large project included both coast lines and the rugged Crown Prince Range which rises to more than 8,000 feet at Mt. Bagana, an active volcano. Although photographic quality was excellent, only uncontrolled mosaics were laid because a ground campaign was not anticipated in that area. A local 1,000 yard grid was applied and the mosaic was sectioned for reproduction at convenient sheet sizes. Terrain ruggedness resulted in large uncorrected scale variations. These, however, were unimportant as far as reconnaissance and aerial spotting were concerned.

Green Island, which lies about 50 miles north of Buka Island and is not usually considered within the Solomon group, was flown by PB4Ys in December 1943. The island deserves mention because it was the first atoll charted from aerial reconnaissance in the South Pacific, a procedure which involved a technique not encountered in large land areas. Atolls, without ground triangulation control, cannot be accurately mapped unless the lagoon can be contained on one run or unless coral heads or shoals occur frequently enough that they can be used in controlling adjacent runs. Obviously, wide angle lenses used at considerable altitude, although sacrificing scale, will result in the most accurate shapes. At the altitude flown, Green Island, although enclosing a lagoon which has a number of coral heads, did not yield a rigid slotted templet assemblage. In such cases, the only recourse is to check the coincidence of topographic points and judiciously incorporate navigational data. A standard combat navigation chart of Green Island was first issued. Prior to occupation, however, a naval reconnaissance party surveyed the approaches and landing beaches. These soundings and navigational data were added to the same base which was then reproduced at 1/30,000.

With the capture of Green Island the Solomons campaign was tactically finished. The photographic squadrons, photogrammetrists, and photographic interpreters turned to the problems of the Bismarck Archipelago. Here the expedients and refinements that were developed in the Solomons were used in compounding the various maps and charts for the different branches of the service. Although survey vessels and geodesists will undoubtedly find the Solomons charts and maps far from perfect, they were made entirely without ground control, frequently with inexperienced men and limited equipment, often with photographs that combined all the vagaries resulting from inclement weather and enemy action, and always under press of time. Unfortunately, fourth order precision could not even be attained, yet these charts and maps materially aided the defeat of the Jap in the Solomons.