

PROGRESS OF PHOTOGRAMMETRY IN U. S. NAVAL SURVEYS

BY

J. M. HAYNIE,

HYDROGRAPHIC OFFICE, U. S. NAVY,

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IN THE NAVY DEPARTMENT'S ORGANIZATION, THE BUREAU OF AERONAUTICS IS THE DIRECTING AGENCY FOR ALL FLYING ACTIVITIES IN THE NAVY, AND, AS SUCH, PROVIDES ALL PHOTOGRAPHIC FLYING REQUIRED BY THE HYDROGRAPHIC OFFICE. THIS ARRANGEMENT IS SIMILAR TO THAT WHICH EXISTS IN THE ARMY, BETWEEN THE AIR CORPS AND THE CORPS OF ENGINEERS.

THE DEVELOPMENT AND PROGRESS OF AERIAL MAPPING IN THE NAVY HAS BEEN ALONG THE SAME GENERAL LINES AND IN THE SAME SEQUENCE THAT HAS PREVAILED THROUGHOUT THIS COUNTRY. MY INTRODUCTION TO AERIAL PHOTOGRAPHY WAS IMMEDIATELY AFTER THE WORLD WAR, THE FIRST ACQUAINTANCE WITH A MAPPING CAMERA BEING ONE KNOWN AS THE L-TYPE. (FIGURE 1.) THIS CAMERA WAS A WAR TIME AMERICAN PRODUCT, CLOSELY RESEMBLING THE FOREIGN TYPES IN USE AT THAT TIME. THE LENS WAS ABOUT 9 1/2 INCHES FOCAL LENGTH. THE CAMERA HAD A CAPACITY OF 24 4-5 INCH GLASS PLATES. THE POSSIBILITIES OF THIS CAMERA, OF COURSE, WERE LIMITED. EXTRA MAGAZINES COULD BE CARRIED AND A CONSIDERABLE NUMBER OF EXPOSURES MADE ON A SINGLE FLIGHT, IF CAMERA FAILURE DID NOT OVERTAKE YOU. A FULL MAGAZINE WAS CARRIED ON TOP WITH A SIMILAR MAGAZINE ON THE SIDE TO RECEIVE THE PLATES AFTER EXPOSURE. AFTER EXPOSURE, THE PLATES WERE SHIFTED ACROSS AND DROPPED INTO THE EMPTY MAGAZINE. BREAKAGE OF ONE OR MORE OF THE FIRST FEW PLATES WAS FREQUENT AS THEY HAD TO TAKE ABOUT A 1/2 INCH DROP TO THE BOTTOM OF THE RECEIVING MAGAZINE. IN SPITE OF SUCH DIFFICULTIES, SOME VERY SATISFACTORY PHOTOGRAPHS WERE OBTAINED, AND THEY WERE MADE INTO VERY FINE COMPOSITES OR MOSAICS. IT IS INTERESTING TO NOTE THAT THESE EARLY EFFORTS WERE CALLED "MOSAIC MAPS". THE VERY UNFORTUNATE THOUGHT OCCURRED THAT OUR "MOSAIC MAP" MEASUREMENTS SHOULD BE CHECKED AGAINST SOME ACTUAL GROUND DISTANCES. IT WAS IMMEDIATELY DECIDED THAT THE WORD "MAP" SHOULD BE DROPPED FROM THE TITLE AND THAT THEY SHOULD MERELY BE CALLED "AERIAL MOSAICS", A PRACTICE, I BELIEVE, IN GENERAL USE TODAY. PATCHING TOGETHER A MOSAIC FROM 4x5 INCH PRINTS WAS DIFFICULT, AS THE SMALL SIZE OF THE PAPER LIMITED THE AMOUNT OF PULL OR STRETCH THAT COULD BE APPLIED. THIS WAS VERY NECESSARY IF A GOOD IMAGE WAS TO BE SECURED. THE IDEA WAS CONCEIVED THAT IF THE NEGATIVES WERE ENLARGED TWICE, THE RESULTING 8x10 INCH PRINT WOULD PERMIT TWICE AS MUCH STRETCHING, THEREBY ENHANCING THE POSSIBILITY OF COMPLETING THE ASSEMBLY. THIS SCHEME REALLY WORKED MARVELOUSLY.

ABOUT THIS TIME, THE EASTMAN TOPOGRAPHIC CAMERA CAME ON THE MARKET. (FIGURE 2.) THIS CAMERA WAS A DISTINCT ADVANCE IN AERIAL CAMERA DESIGN. IT MADE AN EXPOSURE ABOUT 7 x 9 INCHES AND USED A ROLL OF FILM 75 FEET LONG, PERMITTING AT LEAST 100 EXPOSURES PER CAMERA LOADING. THE CAMERA WAS EQUIPPED WITH SEVERAL DETACHABLE CONES CARRYING LENSES OF DIFFERENT FOCAL LENGTHS. THOSE USED IN THE NAVY HAD LENSES OF 10, 12 AND 20 INCHES FOCUS. THIS CAMERA WAS A REMARKABLE INSTRUMENT. ALTHOUGH IT HAS LONG BEEN OBSOLETE IN THE ARMY AND NAVY, IT IS MY UNDERSTANDING THAT THEY ARE STILL USED BY SOME OF OUR COMMERCIAL OPERATORS AND STILL PRODUCE EXCELLENT RESULTS. THESE EARLY CAMERAS HAD NO COLLIMATING MARKS; IN FACT, NO ONE HAD HEARD OF SUCH THINGS. WHO WANTED TO LOOK AT UGLY BLACK NOTCHES SPOILING AN OTHERWISE BEAUTIFUL VERTICAL PHOTOGRAPH? IT FELL TO MY LOT TO INSTALL COLLIMATING MARKS IN ONE OF THESE EARLY CAMERAS. AS I RECALL THE OCCASION, FOUR LITTLE BRASS TRIANGLES WERE SOLDERED IN PLACE TO INDICATE THE EXACT OPTICAL CENTER OF THE LENS, AS MEASURED TO THE NEAREST QUARTER INCH ON A SIX FOOT RULE. I HATE TO THINK WHAT SOME OF OUR MEMBERS WOULD SAY, SHOULD THEY ATTEMPT TO USE SOME PRINTS WITH THIS PARTICULAR SET OF COLLIMATING MARKS INDICATING THE CENTER. PRIOR TO THE ADVENT OF THIS CAMERA, ABOUT THE LARGEST ROLL OF FILM IN GENERAL USE WAS FOR A 3-A KODAK. THE FIRST FILM WAS ORTHOCHROMATIC. I WELL REMEMBER MY FIRST ATTEMPT TO DEVELOP A 75-FOOT FILM BY ROLLING IT BACK AND FORTH IN TRAYS. I HAVE HEARD PEOPLE CLAIM THEY MASTERED THIS PROCEDURE, BUT I'LL ADMIT, I DID NOT. I ALWAYS MANAGED A FEW "FINGER NAIL DIGS" NOT TO MENTION DEVELOPER AND FIXING BATH

STREAKS. SOON THE EASTMAN KODAK COMPANY GAVE US AN OUTFIT TO FACILITATE DEVELOPMENT OF THE LARGE FILM. NEXT CAME A PANCHROMATIC EMULSION. THIS WAS ANOTHER REAL ADVANCE FOR AERIAL PHOTOGRAPHY.

CAMERAS, FILM AND LABORATORY PROCESSING HAD IMPROVED TO THE POINT WHERE UNIFORM AND SATISFACTORY RESULTS COULD BE EXPECTED FROM EVERY PHOTOGRAPHIC MISSION. THE ONE RETARDING FACTOR THAT REMAINED WAS THE AIRPLANE. THE ONLY PLANE IN THE NAVY THAT WAS ADAPTED FOR A MAPPING CAMERA WAS THE R-6-L. (FIGURE 3.) AT THIS TIME THE NAVY HAD NO LAND PLANES. THE R-6-L WAS A TWIN FLOAT SEAPLANE, POWERED WITH A 400 HORSE POWER LIBERTY ENGINE. IT HAD A CRUISING SPEED OF ABOUT 70 MILES PER HOUR, CARRIED ABOUT  $3\frac{1}{2}$  HOURS FUEL, AND NORMALLY COULD BE EXPECTED TO OPERATE AT SIX OR SEVEN THOUSAND FEET WITH CAMERA EQUIPMENT.

ABOUT THIS TIME, THE FAIRCHILD AERIAL CAMERA CORPORATION OFFERED THE FIRST OF THEIR WELL-KNOWN LINE OF MAPPING CAMERAS. MAJOR BAGLEY'S T-1, OR THREE LENS CAMERA HAD BEEN PROVEN. THE RADIAL LINE METHOD OF INTERSECTION HAD BEEN CONCEIVED. FROM HERE ON, PROGRESS HAS BEEN TOO RECENT TO MENTION. THE APPLICATION OF AERIAL PHOTOGRAPHS TO MAP CONSTRUCTION "CAUGHT ON" WITH ALMOST UNIVERSAL RECEPTION. PROGRESS WAS RAPID. THE RADIAL LINE METHOD HAD GIVEN US A SCIENTIFIC METHOD FOR PLOTTING THE PHOTOGRAPHS. IN MY OPINION, THIS METHOD HAS BEEN THE GREATEST SINGLE CONTRIBUTION TO PHOTOGRAMMETRY. PLANIMETRIC MAPS OF GREATER ACCURACY AND DETAIL WERE BEING COMPILED. METHODS AND INSTRUMENTS FOR CONTOURING WERE A NORMAL DEVELOPMENT TO BE EXPECTED. AS WE ALL KNOW, TODAY, WE HAVE THESE INSTRUMENTS AND METHODS, BOTH OF PROVEN ACCURACY. IT IS ONLY REASONABLE TO LOOK FORWARD TO FURTHER DEVELOPMENT AND PRECISION ALONG THIS LINE. I ANTICIPATE FURTHER PROGRESS, PARTICULARLY IN OUR OWN COUNTRY, WITH OUR OWN METHODS AND INSTRUMENTS.

THE HYDROGRAPHIC OFFICE HAD BEEN EXPERIMENTING WITH AERIAL PHOTOGRAPHS, AND, WITH THE ADOPTION OF THE RADIAL LINE METHOD, AERIAL PHOTOGRAPHY BECAME A VITAL PART OF ALL SURVEYS, AND SO CONTINUES. THE FIRST PHOTOGRAPHS UNDERTAKEN FOR HYDROGRAPHIC CHART CONSTRUCTION WERE ALONG THE SOUTH COAST OF CUBA, IN THE ISLE OF PINES - GULF OF BATABANO AREA. OUR FIRST EXPEDITIONS WERE AGAIN HANDICAPPED BY LACK OF A PROPER AIRPLANE. THE PLANE USED (FIGURE 4) WAS A FURTHER REFINEMENT OF THE R-6-L TYPE. THE PERFORMANCE OF THIS PLANE WAS CONSIDERABLY IMPROVED, BUT THE GREATEST DRAWBACK WAS THAT IT WAS STILL A SEAPLANE. THERE WERE NO FACILITIES FOR HAULING THE PLANE FROM THE WATER. OPERATING AND MAINTAINING THIS TYPE OF PLANE FROM A MOORING HAD ITS HAZARDS. THE NEXT REAL ADVANCE FOR AERIAL PHOTOGRAPHY IN THE NAVY WAS THE LOENING AMPHIBIAN PLANE (FIGURE 5). THIS PLANE WAS A RADICAL DEPARTURE FROM THE CONVENTIONAL TYPE AND WAS THE ANSWER TO THE NAVY'S REQUIREMENTS FOR A SATISFACTORY PLANE FOR PHOTOGRAPHIC FLYING IN ISOLATED AREAS. IT WAS POWERED WITH A 400 HORSE POWER INVERTED LIBERTY ENGINE, ALSO A DEPARTURE FROM THE CONVENTIONAL METHOD OF ENGINE MOUNTING. ITS SPEED, RANGE, CLIMB AND GENERAL PERFORMANCE WAS MUCH IMPROVED OVER THE PREVIOUSLY USED TWIN FLOAT SEAPLANE. THE PLANE COULD OPERATE WITH LITTLE ATTENTION FROM THE SURVEY SHIPS. ANY SAND SPIT, ISLAND OR CAY WAS A SATISFACTORY OPERATING BASE. NO EXTRA EQUIPMENT WAS REQUIRED FOR GETTING THE PLANE OUT OF THE WATER. IT COULD TAXI FROM THE WATER TO THE SAFETY OF LAND UNDER ITS OWN MOTIVE POWER. A TRIBUTE TO THIS PLANE IS THAT THE MAJOR PART OF THE MAIN SHORELINE OF CUBA, WITH THE HUNDREDS OF ADJACENT ISLANDS, CAYS AND REEFS HAVE BEEN MAPPED WITH THIS TYPE. ON COMPLETION OF THE CUBAN PROJECT, SURVEY OPERATIONS WERE CONTINUED ALONG CERTAIN SECTIONS OF BOTH THE ATLANTIC AND PACIFIC COASTS OF CENTRAL AND SOUTH AMERICA. IT IS IN THESE AREAS THAT HYDROGRAPHIC SURVEYS ARE NOW BEING CONDUCTED. PHOTOGRAPHIC FLYING FOR ALL THESE PROJECTS HAS BEEN EXECUTED BY THE NAVY, EXCEPT THE SHORELINE OF COLOMBIA, WHERE PHOTOGRAPHS WERE FURNISHED BY THAT GOVERNMENT. PRACTICALLY ALL PHOTOGRAPHIC MAPPING ACCOMPLISHED BY THE BUREAU OF AERONAUTICS HAS BEEN FOR THE HYDROGRAPHIC OFFICE, WITH TWO NOTABLE EXCEPTIONS. IN 1926, AT REQUEST OF THE DEPARTMENT OF THE INTERIOR, THE NAVY SENT AN EXPEDITION TO SOUTHEASTERN ALASKA TO WORK IN COOPERATION WITH THE U. S. GEOLOGICAL SURVEY. ABOUT 10,000 SQUARE MILES WERE PHOTOGRAPHED THAT SEASON, USING THREE LENS CAMERAS AND LOENING PLANES. UNDER A LIKE ARRANGEMENT, THE NAVY SENT ANOTHER EXPEDITION TO ALASKA IN 1929 TO CONTINUE THIS SURVEY NORTHWARD. MR. SARGENT, OF THE GEOLOGICAL SURVEY, HAS STATED MANY TIMES HOW INDISPENSABLE THESE PHOTOGRAPHS HAVE

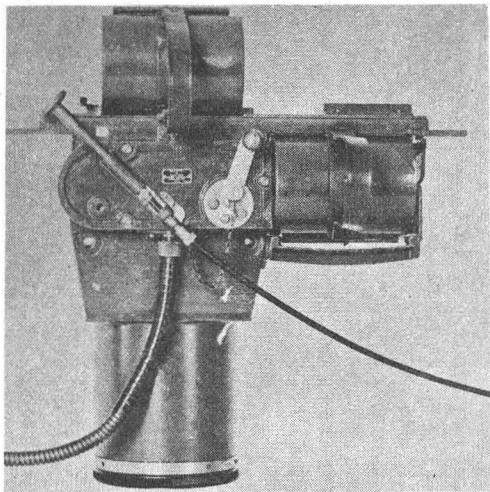


Fig. 1. L- Type Mapping Camera.

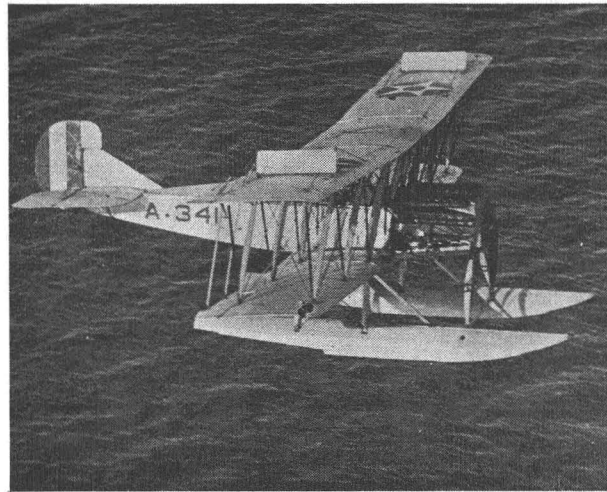


Fig. 3. R-6-L seaplane, an early Navy photographic mapping plane.

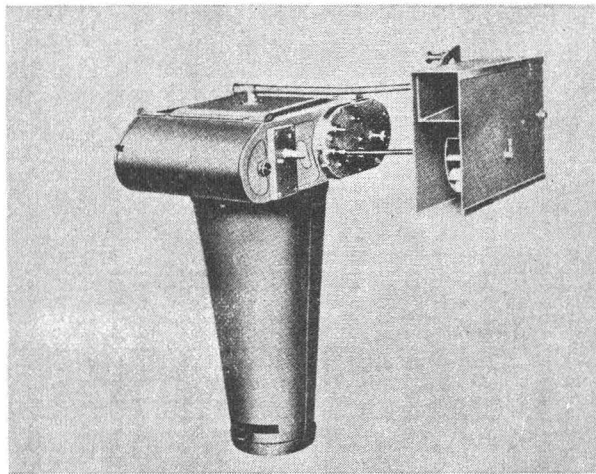


Fig. 2. Eastman Topographic Camera, Type K-1.

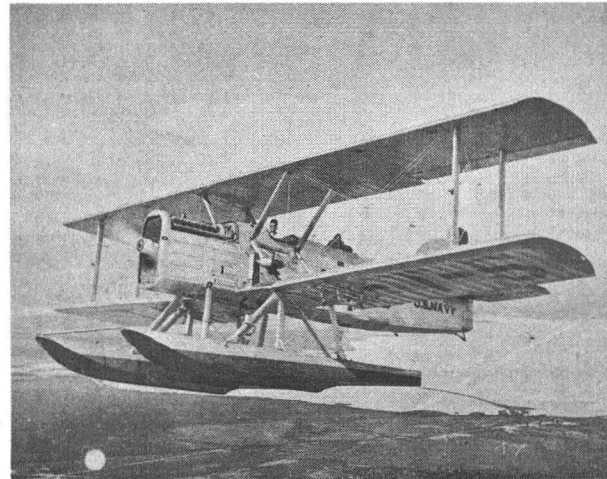


Fig. 4. DT plane with Liberty engine, an early type used in hydrographic survey work in Cuba.

NAVY DEPARTMENT  
OFFICE OF THE CHIEF OF BUREAU OF AERONAUTICS  
WASHINGTON, D. C.  
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BEEN TO THEIR ALASKA MAPPING PROGRAM. IN 1929, T-2 OR FOUR LENS CAMERAS WERE USED WITH LOENING PLANES.

IT WOULD PROBABLY BE OF INTEREST TO MENTION SOME OF THE PHOTOGRAPHIC DIFFICULTIES ENCOUNTERED ON SOME OF THESE EXPEDITIONS. THE USUAL OPERATING BASE IN CUBA WAS AN ISOLATED SAND SPIT OR MANGROVE CAY (FIGURE 6). MANY ROLLS OF PANCHROMATIC FILM HAVE BEEN DEVELOPED IN AIRPLANE CRATES, CANVAS TENTS, AND ON THE SUPERSTRUCTURE OF A SHIP AMONG DECK WINCHES, BOATS AND BOOMS. THE HYDROGRAPHIC OFFICE HAS MANY ROLLS OF EXCELLENT QUALITY FILM, NONE THE WORSE FOR THEIR DEVELOPMENT UNDER CUBAN STARLIGHT. IT IS THOUGHT THAT THE EXPERIENCE OF NAVY PHOTOGRAPHERS IS UNIQUE, IN THAT MUCH OF OUR MAPPING FILM HAS BEEN PROCESSED WITH A COMPLETE LACK OF ACCEPTABLE LABORATORY FACILITIES. ROLLS OF FILM HAVE BEEN PLACED IN THE SEA TO WASH. PRINTS HAVE BEEN PLACED IN A WIRE CAGE AND THROWN IN THE SEA TO WASH - SOAK IS PERHAPS A BETTER TERM. THIS PRACTICE IS NOT RECOMMENDED TO REPLACE CORRECT LABORATORY PROCEDURE BUT ILLUSTRATES WHAT CAN BE DONE UNDER CONDITIONS OF ADVERSE NECESSITY. THE HUNDREDS OF ROLLS OF EXCELLENT FILM OF THE CUBAN COAST ARE A TRIBUTE TO THE RESOURCEFULNESS OF NAVY AND MARINE CORPS PHOTOGRAPHERS WHO WORKED ON THIS PROJECT. I MIGHT ADD THAT WE HAVE LEARNED THAT SEA WATER IS QUITE SATISFACTORY FOR WASHING FILM OR PRINTS. IN THE CASE OF FILM, A FINAL RINSE MUST BE GIVEN IN FRESH WATER. WITH PRINTS, ALL SALT WATER WASHING IS ENTIRELY SATISFACTORY.

PRIOR TO 1931, ALL PHOTOGRAPHS USED BY THE HYDROGRAPHIC OFFICE WERE SINGLE LENS. SINCE THAT TIME, FIVE LENS HAVE PROBABLY PREDOMINATED. THE SAME OLD CONTROVERSIAL QUESTION IS WITH US, THAT OF CHOOSING BETWEEN SINGLE LENS AND FIVE LENS CAMERAS. GREATER COVERAGE AND BETTER PLOTTING ACCURACY, OF COURSE, ARE OBTAINED FROM THE FIVE LENS. BETTER SHORELINE DETAIL, WITH SPECIAL WEIGHT TO SMALL ROCKS, SUBMERGED ROCKS, BREAKERS, LEDGES, REEFS, AND SHOALS ARE OBTAINED FROM THE SINGLE LENS. ON ONE PROJECT, THE IDEAL EXISTED. FIVE LENS PHOTOGRAPHS ON A SCALE OF 1:30,000 WERE MADE OF THE ENTIRE AREA. CERTAIN HARBORS AND ANCHORAGES SELECTED FOR CLOSER AND CONSEQUENTLY LARGER SCALE DEVELOPMENT WERE PHOTOGRAPHED AGAIN AT A MUCH GREATER SCALE WITH A SINGLE LENS CAMERA. THIS ARRANGEMENT SATISFIED ALL REQUIREMENTS. OUR EXPERIENCE WITH 1:30,000 FIVE LENS PHOTOGRAPHS HAS INDICATED THAT THE SCALE IS GENERALLY TOO SMALL FOR HYDROGRAPHIC CHART WORK. ALTHOUGH THE PHOTOGRAPHS WERE OF EXCELLENT QUALITY, IT WAS PRACTICALLY IMPOSSIBLE TO DISTINGUISH UNDERWATER ROCKS, LEDGES, REEFS OR KELP. A 1:20,000 SCALE SEEMS TO BE THE MOST ADAPT-ABLE WHEN FIELD DEVELOPMENT IS AT THAT SCALE OR SMALLER. THERE ARE TIMES WHEN A LARGER SCALE WOULD BE PREFERABLE, BUT WITH ALL FACTORS CONSIDERED, A 1:20,000 IS PERHAPS THE BEST UNIVERSAL SCALE WE CAN HOPE FOR WITH FIVE LENS CAMERAS IN THE TYPE OF COUNTRY BEING SURVEYED.

THE USUAL PROCEDURE IS TO HAVE THE PICTURES FLOWN A YEAR IN ADVANCE OF THE FIELD PARTY. TWO SETS OF PRINTS ARE FURNISHED BY THE BUREAU OF AERONAUTICS. ONE SET IS USED TO MAKE A PRELIMINARY RADIAL PLOT, WITHOUT REFERENCE TO GROUND CONTROL, WHICH, OF COURSE, IS NOT YET AVAILABLE. ALL INFORMATION AND DETAIL VISIBLE ON THE PHOTOGRAPHS IS INCORPORATED IN THESE PLOTS. THE SCALE, OF COURSE, IS VARIABLE AND THE AZIMUTH USUALLY IN ERROR. THESE PLOTS, WITH THE SET OF PRINTS USED, ARE TURNED OVER TO THE SHIPS BEFORE THEIR DEPARTURE FOR THE SURVEY GROUNDS. THEY ARE USUALLY THE ONLY SOURCE OF INFORMATION SHOWING LAND FEATURES IN ANYTHING LIKE THEIR PROPER RELATION AND DETAIL. THESE PLOTS ARE USED FOR RECONNAISSANCE AND ARE PARTICULARLY VALUABLE IN PRELIMINARY PLANNING OF THE CONTROL NET. AS FAST AS GROUND CONTROL IS OBTAINED, THE PLOTS ARE ADJUSTED FOR APPROXIMATE SCALE AND AZIMUTH AND THEIR INFORMATION TRANSFERRED TO THE FIELD SHEETS WHERE IT IS READILY AVAILABLE FOR USE ON THE SOUNDING SHEETS. THE PRINTS ARE TAKEN INTO THE FIELD WHERE GROUND CONTROL IS SPOTTED. NOTES ON QUESTIONABLE FEATURES ARE MADE ON THE PRINTS. THE SECOND SET OF PRINTS IS USED FOR FINAL SMOOTH PLOTTING AFTER THE SURVEY SHIPS HAVE RETURNED TO THE STATES. THE PRACTICE OF THIS OFFICE IS TO TAKE ALL INFORMATION THAT CAN BE OBTAINED FROM THE PHOTOGRAPHS. THIS PRACTICE IS A REASON FOR FIVE LENS PREFERENCE, DUE TO THE GREATER COVERAGE. THE HYDROGRAPHIC OFFICE IS LESS FORTUNATE THAN MOST OF OUR OTHER MAPPING AGENCIES, IN THAT FIELD CHECKING IS NEVER POSSIBLE. WHEN FIELD WORK IS COMPLETED IN AN AREA, THAT AREA IS NOT SEEN AGAIN BY THE SURVEY PARTY. OUR FIELD WORK MUST BE THOROUGH AND COMPLETE. WE MAKE EVERY EFFORT TO EXECUTE ACCURATE AND COMPLETE



Fig. 5. Early Loening amphibian used for many years for photographic mapping by the Navy.

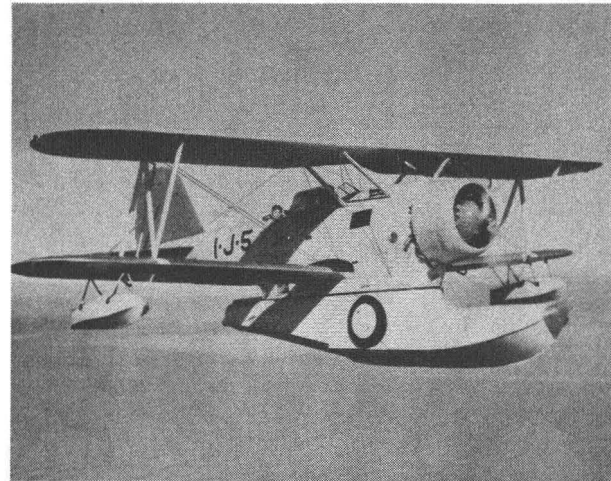


Fig. 7. Grumman amphibian plane, Type JF, the present photographic mapping plane used by the Navy.

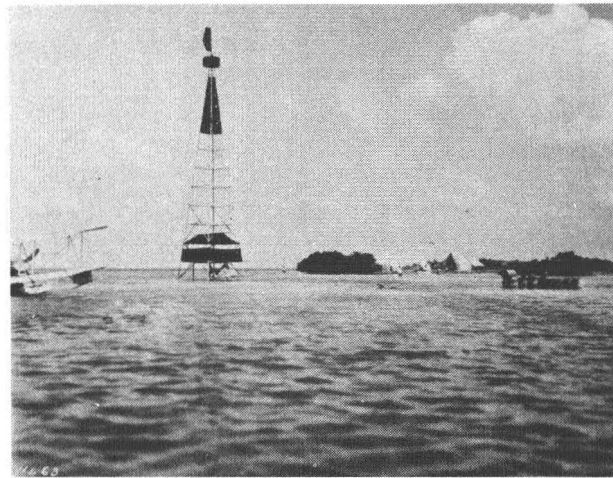


Fig. 6. Typical operating base for aerial photography in Cuba, showing 100 foot steel tower used as a main triangulation station.

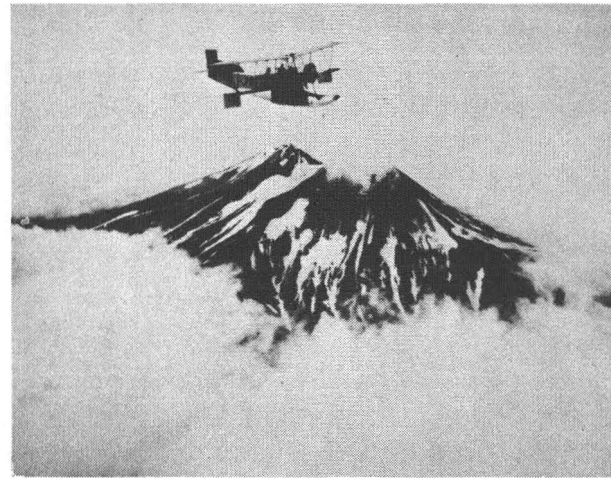


Fig. 8. Prominent peak with top above cloud formations, a condition frequently encountered near water areas.

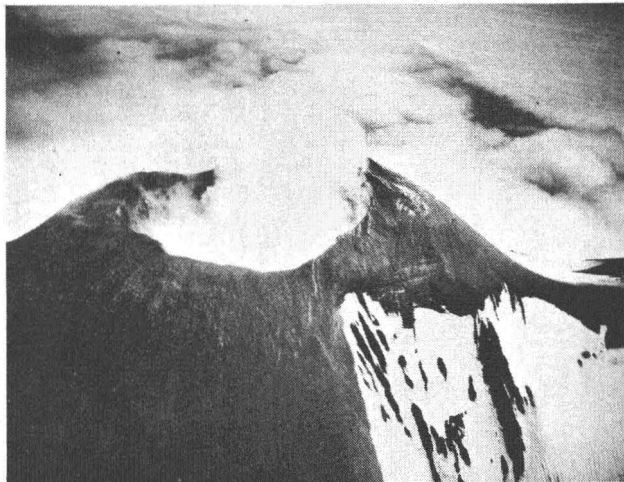


Fig.9. Prominent peak rising above clouds, frequently encountered near water areas.

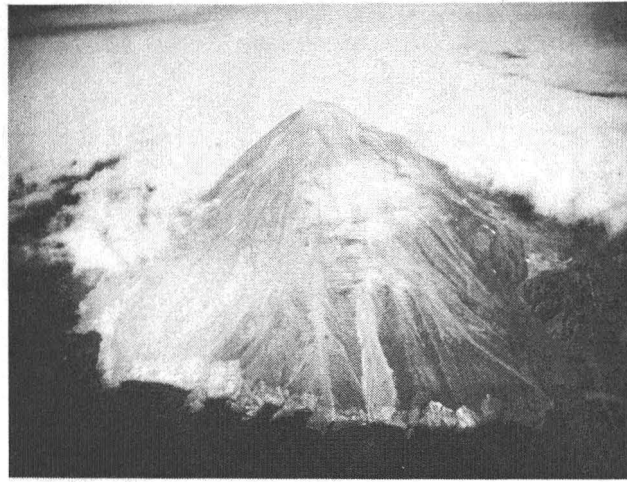


Fig.11. Prominent and isolated peaks extending above cloud formations.



Fig.10. Prominent and isolated peaks extending above cloud formations.

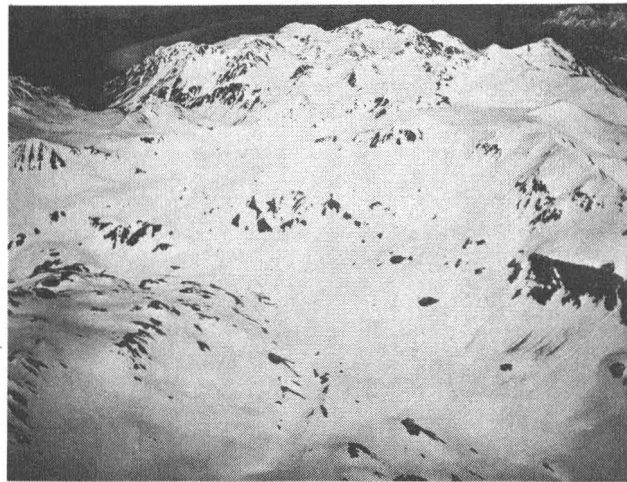


Fig.12. A view typical of much of Alaska that is still unsurveyed.



DATA FROM THE PHOTOGRAPHS.

AT THIS TIME ABOUT 600 LINEAR MILES OF FLYING IS BEING DONE ALONG THE ATLANTIC COAST OF PANAMA, COSTA RICA AND NICARAGUA. A FIVE LENS CAMERA IS BEING USED WITH A GRUMMAN AMPHIBIAN PLANE (FIGURE 7). THIS PLANE HAS SUPERSEDED THE LOENING AS THE PHOTOGRAPHIC PLANE IN THE NAVY. IT HAS A SERVICE CEILING OF OVER 20,000 FEET, A GREATLY INCREASED SPEED AND A VERY RAPID RATE OF CLIMB. IT IS POWERED WITH A 14 CYLINDER IN-LINE AIR COOLED ENGINE. WE SPEAK OF LINEAR MILES INSTEAD OF SQUARE MILES AS MOST OF THIS FLYING WILL BE A SINGLE STRIP WHERE THE SHORELINE WILL BE HELD NEAR THE CENTER OF FLIGHT. PARALLEL FLIGHTS ARE REQUIRED IN CERTAIN AREAS WHERE LAGOONS, LARGE RIVERS OR OTHER SHORELINE IRREGULARITIES EXIST. IN SQUARE MILE AREA, THIS IS APPROXIMATELY 6,000 AND IS BEING FLOWN AT A 1:20,000 SCALE. FOR THIS WORK, FLIGHT LINES WERE LAID DOWN ON THE BEST EXISTING CHART AND WERE INCLUDED IN THE SPECIFICATIONS. I MIGHT ADD THAT THE STANDARD SPECIFICATIONS OF THIS SOCIETY ARE A GUIDE, USING THOSE PARTS APPLICABLE TO OUR PARTICULAR NEEDS. WE SPECIFY THE ULTIMATE, HOPE FOR THE BEST, AND TAKE WHAT WE GET. OUR FLYING HAS BEEN VERY SATISFACTORY AND AS GOOD AS COULD BE EXPECTED UNDER THE EXISTING CIRCUMSTANCES. WE CANNOT REPORT ANY CASES OF 200 AND 300 PERCENT FAILURES, AS MR. WOODWARD DID. HOWEVER, WE HAVE HAD ONE CASE OF 100 PERCENT FAILURE WHERE THE ENTIRE AREA HAD TO BE REFLOWN.

THE INCREASED OPERATING RANGE OF MILITARY, NAVAL AND COMMERCIAL AIRCRAFT HAS MADE IT DESIRABLE TO INCORPORATE ALL OBTAINABLE AIRCRAFT NAVIGATIONAL AIDS ON OUR CHARTS. THE CORRECT POSITION AND SHAPE OF MOUNTAINS, PARTICULARLY PROMINENT ISOLATED PEAKS ARE DESIRABLE. IT FREQUENTLY HAPPENS THAT THE SURFACE WEATHER IS WHAT IS TERMED "SOUPY" AND UNSAFE FOR AIRCRAFT NAVIGATION. ON MANY SUCH DAYS, IF A PLANE GETS ABOVE THE CLOUD LAYER, THE SUN WILL BE BRILLIANT WITH AN UNLIMITED CEILING AND VISIBILITY (FIGURE 8), THE ONLY LAND VISIBLE BEING ISOLATED PEAKS PROTRUDING THROUGH THE CLOUDS. (FIGURE 9.) SAFE AND ACCURATE AIR NAVIGATION CAN BE ACCOMPLISHED, PROVIDING THESE PEAKS ARE CORRECTLY DELINEATED AND CAN BE DEFINITELY IDENTIFIED BY THEIR SHAPE AND HEIGHT AS SHOWN ON THE AVIATORS CHART. THIS WE TRY TO DO ON OUR CHARTS. (FIGURE 10.) PEAK TO PEAK NAVIGATION IS ENTIRELY FEASIBLE WHEN THESE CONDITIONS EXIST. (FIGURE 11.) A HIGH ACCURACY IS NOT CLAIMED FOR THIS TYPE OF WORK; HOWEVER, THE CHARTS ARE THE ONLY ONES IN EXISTENCE SHOWING TOPOGRAPHY AND THEREFORE ARE THE BEST ONES. A CORRECT HEIGHT IS ASSURED FROM FIELD DETERMINATIONS, A CORRECT SHAPE IS ASSURED FROM THE PHOTOGRAPHS. THE NAVIGATOR IS CONCERNED WITH THESE TWO FACTORS AND NOT PARTICULARLY INTERESTED IN LINES OF EQUAL ELEVATION. THE METHODS EMPLOYED HAVE BEEN DISCUSSED IN THE PREVIOUS PAPER. ANOTHER FIGURE (FIGURE 12) WILL PROBABLY BE INTERESTING, A VIEW CHARACTERISTIC OF MUCH OF ALASKA THAT IS STILL UNSURVEYED. THIS APPEARS A FERTILE FIELD FOR STEREOSCOPIC CONTOURING. THE MANY LITTLE PEAKS ARE ABOUT 4,000 FEET ELEVATION. PLANE TABLING SEEMS IMPRACTICAL IF NOT ENTIRELY IMPOSSIBLE. THE SUMMER SNOW LINE IS APPROXIMATELY 1,500 FEET. WALKING ABOVE THE SNOW LINE CAN ONLY BE ACCOMPLISHED WITH A GREAT DEAL OF EFFORT AND AT A "SNAIL'S PACE."

I THINK IT CAN BE SAID THAT PHOTOGRAMMETRY IN THE HYDROGRAPHIC OFFICE IS DEFINITELY ON THE UP-GRADE. THE PERFORMANCE OF OUR PLANES HAS IMPROVED; OUR PHOTOGRAPHIC FLYING AND PHOTOGRAPHY IS IMPROVING; OUR SPECIFICATIONS ARE BETTER; COOPERATION BETWEEN FLYING PERSONNEL, FIELD PARTIES AND COMPILATION FORCE IS IMPROVING; - ALL THIS, WE BELIEVE, IS PRODUCING MORE ACCURATE AND MORE COMPLETE CHARTS. SO FAR, WE HAVE CONFINED OURSELVES TO GRAPHICAL METHODS OF PLOTTING, BUT ARE WATCHING THE DEVELOPMENT OF OTHER METHODS AND STEREOSCOPIC INSTRUMENTS WITH KEEN INTEREST. INCREASED USES FOR PHOTOGRAMMETRY SEEM ASSURED. NO SURVEYS WILL BE UNDERTAKEN WITHOUT AERIAL PHOTOGRAPHS. SHORELINE REVISION OFFERS A FIELD THAT IS YET UNTOUCHED. THERE ARE EXTENSIVE AREAS, PRINCIPALLY IN OUR AMERICAN TROPICS, THAT WERE SURVEYED BEFORE THE AERIAL PHOTOGRAPH HAD ARRIVED. IT IS QUITE PROBABLE THAT MOST OF THIS SHORELINE COULD BE REVISED WITHOUT NEW GROUND CONTROL, AS IT IS THOUGHT THAT A SUFFICIENT NUMBER OF OLD STATIONS COULD BE RECOVERED FOR CONTROLLING THE PHOTOGRAPHS. LITTLE USE HAS BEEN MADE OF OBLIQUE PHOTOGRAPHS. THEIR APPLICATION SEEMS TO OFFER MANY POSSIBILITIES WITH CERTAIN TYPES OF WORK, SUCH AS RUNNING SURVEYS, RECONNAISSANCE AND EXPLORATORY SURVEYS.

FOR YEARS, AS AN AERIAL PHOTOGRAPHER, I HAD, PERHAPS, FELT THE USUAL AMOUNT OF PRIDE IN MY WORK. ALTHOUGH THE PHOTOGRAPHIC QUALITIES OF THESE EFFORTS LEFT LITTLE TO BE DESIRED, SINCE ATTEMPTING TO BECOME A PHOTOGRAMMETRIST, I CERTAINLY CAN REALIZE THE LOW CHARACTER OF SOME OF THIS SAME WORK, OF WHICH I WAS PREVIOUSLY SO PROUD. IN FACT, SOME OF THE WORK WHICH I HAVE DONE WAS UTTERLY UNSATISFACTORY AND REJECTABLE. IT WAS CAUSED, NOT BY LACK OF HARD WORK, FOR WE HAVE FLOWN ALL DAY AND DEVELOPED FILM ALL NIGHT, BUT CAUSED BY A LACK OF KNOWLEDGE AND UNDERSTANDING OF THE NECESSARY ESSENTIALS OF AN AERIAL PHOTOGRAPH BEFORE IT CAN BE PROPERLY TRANSMITTED TO CHART FORM. THESE MORE COMMON FAULTS OR MISTAKES ARE DESIGNATED AS FOLLOWS:

OCCASIONAL FAILURE TO OBTAIN 60% OVERLAP;

MAKING AN EXPOSURE WHILE THE PLANE WAS SKIDDING OR TURNING;

FAILURE TO PROPERLY CORRECT FOR CRAB;

ATTEMPTING TO PHOTOGRAPH THROUGH CLOUDS, AND MANY OTHERS.

THESE MISTAKES AND RESPONSIBILITY FOR THEM ARE EQUALLY APPLICABLE TO THE PILOT. THE PILOT AND PHOTOGRAPHER SHOULD BE CONSIDERED AS A TEAM, NOT AS INDIVIDUALS. IF THEY ARE NOT A TEAM, ALL THEIR EFFORTS ARE DOOMED TO FAILURE. IF EVERY TEAM OF PILOT AND PHOTOGRAPHER WERE REQUIRED TO PLOT AN AREA FLOWN BY THEM, THEIR MANY MISTAKES AND THE MANY ANGLES FOR IMPROVING THEIR PROCEDURE WOULD BE BROUGHT HOME IN SUCH A FORCIBLE MANNER THAT THEIR FUTURE PHOTOGRAPHIC MAPPING WOULD BE MUCH IMPROVED, IF NOT NEAR PERFECTION. THERE ARE TIMES, PERHAPS, WHEN PREVIOUS EXPERIENCE AS A PHOTOGRAPHIC PILOT OR PHOTOGRAPHER IS OF VALUE TO THE PHOTOGRAMMETRIST OR CHART COMPILER, BUT NOT NEARLY AS ESSENTIAL AS COMPILATION EXPERIENCE IS TO THE FLYING TEAM.

IN CONCLUSION, I WOULD LIKE TO EMPHASIZE THE CONSTRUCTIVE AND PROGRESSIVE INFLUENCE THAT OUR ORGANIZATION, THE AMERICAN SOCIETY OF PHOTOGRAMMETRY, HAS HAD ON PHOTOGRAMMETRICAL WORK IN THIS COUNTRY. NO DOUBT, ACCOMPLISHMENTS AT THIS EARLY STAGE HAVE SURPASSED THE EXPECTATIONS OF OUR ORGANIZERS. THE EXPERIENCE OF OTHERS IS ONE OF OUR BEST TEACHERS. OUR SOCIETY ACTS AS A "CLEARING HOUSE" FOR THESE EXPERIENCES, FROM WHICH ALL OF US PROFIT. A RAPID GROWTH IN MEMBERSHIP, WIDELY DIFFUSED, INDICATES THAT OUR COUNTRY IS IN A RECEPTIVE MOOD FOR THIS MAPPING ADVANCE. DUE TO THE INFLUENCE OF OUR SOCIETY AND THE INFORMATION MADE AVAILABLE THROUGH OUR PUBLICATION "PHOTOGRAMMETRIC ENGINEERING", THIS WORK IS BECOMING STANDARDIZED. IT IS PROBABLY SAFE TO SAY THAT A HELPFUL INFLUENCE HAS BEEN EXERTED AMONG ALL OUR GOVERNMENTAL SURVEYING AGENCIES. SUCH CAN CERTAINLY BE SAID FOR THE HYDROGRAPHIC OFFICE. SO FAR, IN A FEW YEARS OF LIFE, A REMARKABLE JOB HAS BEEN DONE OF PICKING UP RAGGED ENDS AND METHODS, HERETOFORE KNOWN ONLY TO THE INTERESTED FEW, AND DISSEMINATING THIS INFORMATION WITH THE RESULT THAT STANDARDIZED AND ACCURATE METHODS OF PROCEDURE IN THIS WORK ARE NOW THE RULE RATHER THAN THE EXCEPTION. THERE IS MORE REAL WORK BEFORE US. THESE OCCASIONAL MEETINGS ARE BENEFICIAL TO ALL OF US. THERE ARE STILL A NUMBER OF GOVERNMENTAL AGENCIES THAT COULD PROVIDE A VERY INTERESTING EVENING, AS COULD OUR COMMERCIAL PEOPLE. THE HYDROGRAPHIC OFFICE HAS HAD ITS TIME AT BAT. LETS HOPE OTHERS WILL TAKE THEIR TURN.

#### A PLEA FOR HELP BY THE COMMITTEE ON PUBLICATIONS

NO MATTER HOW EFFICIENT THE COMMITTEE ON PUBLICATIONS MAY BE, IN EDITING COPY FOR PUBLICATION, IN SEEING THAT PRINTING IS PROPERLY DONE AND THAT PHOTOGRAMMETRIC ENGINEERING IS SENT TO THE MEMBERS OF THE SOCIETY, AN INTERESTING MAGAZINE CANNOT BE MAINTAINED WITHOUT AN ADEQUATE SUPPLY OF ARTICLES. FOR EXAMPLE, THIS ISSUE WOULD HAVE BEEN OF CONSIDERABLY GREATER LENGTH IF A SUFFICIENT NUMBER OF ARTICLES, NOT DUPLICATING MATERIAL HERETOFORE INCLUDED, HAD BEEN AVAILABLE. FOR THIS REASON, IT IS EARNESTLY REQUESTED THAT MEMBERS OF THE SOCIETY SUBMIT PAPERS ON VARIOUS ASPECTS OF PHOTOGRAMMETRY FOR PUBLICATION. THE COMMITTEE WILL ALSO BE GLAD TO RECEIVE COPIES OF ARTICLES IN OTHER AMERICAN OR FOREIGN PUBLICATIONS WHICH THE MEMBERS OF THE SOCIETY WOULD BE INTERESTED IN SEEING REPRINTED.