

South African and South American drought recurrences. Widespread and at times catastrophic drought effects are objectives of the highest order.

In a sense nothing is more dull than a series of data. In any event they are humdrum to the public. To the scientist they are the prerequisites of some of the most exciting scientific discoveries. There are no headlines in observations if one must wait at least 30 years for reasonably reliable averages! Yet once the probability of good and bad years becomes better known, better protective measures and a better livestock economy may follow. This means a better economy in general.

## 1947-1948 U. S. NAVY ANTARCTIC EXPEDITION\*

*R. C. Holl, Hydrographic Office, Navy Department*

THE Second Antarctic Development Project was, from the Hydrographic Office viewpoint, a survey expedition supplementing the photographic accomplishments of the Highjump Expedition of the previous year. Highjump, through CNO, had turned over to Hydro. 60,000 trimetrogon mapping prints covering more than one half of the 12,000 miles of Antarctic coastline, together with the responsibility of producing maps from this coverage.

The planners of this Second Antarctic trip recognized the need of some type of geodetic control to obtain the maximum value from our compilations, and assigned top priority to the survey work. Task Force 39, therefore, was planned from the beginning toward the main objective of landing survey parties on the ice covered continent at as many pre-selected points as the short Antarctic summer would permit.

Lacking maps or charts of sufficient detail for a comprehensive scheduling of the four survey groups, mosaics were constructed utilizing the rectified trimetrogon photography controlled by the aerial navigation data of the Highjump pilots. The mosaics covered the two main priority areas, and probable survey locations were marked at specified intervals. These mosaics later proved to be invaluable in reconnaissance operations and final planning before landing.

Due to the anticipated problems of transportation from ship to shore which would necessitate reduction in size of shore parties to the absolute minimum, it was necessary that Hydro. personnel be competent not only in astronomic observation and surveying but also in photogrammetry and magnetic observations. In addition our shipboard duties included oceanographic and hydrographic observations. For several weeks prior to departure, intense training was given to party leaders in these various phases of our intended survey. Dr. Howe of the Coast and Geodetic Survey was extremely helpful in this respect. A very competent instructor in operation of the magnetometer and a veteran of the Highjump expedition, he both instructed us and counselled us on Antarctic conditions which we would encounter.

In November 1947, the two icebreakers U.S.S. Burton Island and U.S.S. Edisto, which comprised T.F. 39, set out from their home ports en route to their

\* Paper read at Annual Meeting of the American Society of Photogrammetry, Washington, D. C., January 13, 1949.

EDITOR'S NOTE: As a part of "1947-1948 U. S. Navy Antarctic Expedition," Mr. Glenn R. Krause of the Hydrographic Office presented a very great number, highly interesting and informative pictures. His description was not only very instructive but at times, extremely amusing. No transcript of his remarks was made. It is hoped that later on Mr. Krause will prepare an illustrated article for publication in PHOTOGRAMMETRIC ENGINEERING.

point of rendezvous; Pago Pago Harbor, in American Samoa. On Dec. 5, the 23,000 mile journey, which ultimately encircled more than 60 per cent of the Antarctic Continental coastline, was begun. The track we followed, the landings we made, will be more interestingly shown you by Mr. Krause's color slides than I could possibly present them. Instead, let me describe to you the icebreakers which carried us on this long voyage, often in water which no other vessel has ever navigated, and with its reinforced steel hull and powerful diesel engines, through ice packs which no other type vessel could traverse. The skipper of the Burton Island, Commander Edwin MacDonald describes his command as follows:

"Displacing close to 6,500 tons when loaded, drawing 29 feet of water, being only 269 feet long and 65 feet wide, and constructed with a round, flat hull so that the ship will shoot up like a pea out of a pod if forced by ice pressure. The modern icebreaker is really more at home in the ice than in the open sea. The slightest swell causes her to roll like a thing possessed. She rolls fifteen or twenty degrees in a normal sea, forty degrees or more during a moderate storm. We dreaded to think what might happen to our peace of mind if we encountered a hurricane swell. On the trip back we did record a roll of fifty-one degrees. It is not a place for the squeamish nor the delicate stomach. Although fiddle boards for the table are employed for most meals, sometimes it is necessary to eat with a cup in one hand and a stanchion in the other. Drawers and doors pop open. Clothes wear themselves out in the lockers. Gear gets loose and sets up a din like a rock-crusher. It is difficult to sleep because the motion constantly and monotonously tosses one back and forth in spite of lubber's rails, wedged mattresses and pillows, and a strangle hold on the bunk.

"But in the ice it is a different story. The ship behaves like a lady. She keeps an even keel, and except for the bumps and jars as the bow strikes the hummocks, it is like riding on a train. The bull-throated bellow of the diesels sounds like the engine. The hills are the growlers and the bergy-bits, the mountains are the bergs, the flat door of the valley is the pack, and the people are the drowsy seals and the curious penguins. It is an interesting journey because it is comfortable and every sight is a new one."

On Dec. 26, the Edisto and B.I. separated to proceed to respective areas of operation. During a staff conference in Samoa, it had been decided that the Edisto survey parties would occupy stations selected between Mt. Gauss and Haswell Island while the B.I. would occupy Haswell and proceed westward to Farr Bay where she was later to be joined by the Edisto for a combined effort to reach Hippo Nunatak more than 100 miles across the Shackleton ice shelf.

Operations proceeded smoothly; the Edisto moved through the ice to within 15 miles of point two and 35 miles of point one. On Dec. 28 their helicopter landed parties at both stations. Meanwhile, the Burton Island had pushed her nose into the pack ice 17 miles north of Haswell Island, and also on Dec 28, moved their first party by weasel across the solid pack to establish a base on this rock island.

Our first bit of bad luck occurred when the B.I.'s Sikorsky helicopter landed at Gillies Nunatak, a point midway across the Shackleton ice shelf. This was to be both survey station and refueling base for the longer trip across the shelf to Hippo. As the plane landed, it had slid down an icy slope to come to rest in a small depression, damaging its float landing gear to such extent that it was impossible to take off again without tools and assistance. The other Burton Island helicopter was inoperative at the time so that help was requested from the Edisto. The Edisto's helicopter transferred to the Burton Island and in

approximately twenty four hours the damaged plane was back aboard. A cooperative sun had allowed the survey party to complete its observations and return with it.

With only one helicopter in operation, and the survey at the midway ice shelf station completed, plans to reach the distant Hippo Nunatak were abandoned.

Our next scheduled point was "Bungers Lakes." These "lakes" had received considerable publicity in magazine and press since Lt. Comdr. Bungler had discovered them during Operation Highjump. Some of the Sunday supplements had even pictured palm trees and blue lagoons, theorizing it to be a volcanic land heated by internal fires and hot springs. All we actually knew was that the area was practically free of snow and ice and that the water samples brought back by Comdr. Bungler had shown a salt content equivalent to sea water. This station, therefore, was a must on our agenda.

But now the solid pack gave us trouble, lead after lead was explored and abandoned as its terminus left us beyond helicopter range of the coast. Finally the Edisto pushed through to an open water area 44 miles from "Bungers." The Burton Island, 40 miles to the northeast, dispatched its survey parties and helicopters to the Edisto; from that base, landings were accomplished.

The extensive triangulation of this area was considerably curtailed when the helicopters, which were to return with radio and other gear, failed to show up after 24 hours. Lacking the transportation they were to provide to distant stations, plans were hurriedly revised; when two of the aircraft finally showed up after about 60 hours, only three stations had been occupied.

And now the planes had not come to assist but instead to evacuate us. Continuous storms between us and the ship had prevented their prior return. The Bell Helicopter, in attempting to reach us, had encountered a condition peculiar to the Antarctic, a white day, which merges ice, snow, and sky into one lacking all indications of a horizon. Turning back to the ship, the pilot flew into the pack ice with the result that the aircraft was a total loss. Luckily the pilot and crewman escaped with only cuts and bruises. As our primary objectives had been completed and with new storms predicted, we reluctantly returned to ship.

We now moved on to the last two survey points in this first general area. These points were found to be easily accessible. A short helicopter flight placed the Edisto party on a rock outcrop along the Knox Coast, while the Burton Island moved on into open water dotted with numerous small rock islands at a point where the Knox Coast merged with the Budd Coast. On the largest of these islands a survey party of eight was landed by motor whale-boat. This party established an astronomic station with seventeen hourly sets of sun sights, measured a two mile baseline, occupied four triangulation stations, utilizing three of these stations to obtain terrestrial photography, located seven intersection stations, and finished two complete sets of magnetic measurements. All this was accomplished in thirty hours.

On January 20th, operations in this first priority area were completed and the two ships got underway for McMurdo Sound and Little America. In twenty-three days we had established photo control at nine separate points along 700 miles of coastline.

Moving into the Ross Sea, we stopped at Ross Island long enough to make magnetic observations; then on to Little America. The Hydrographic Office planned no projects there, but we established a position in conjunction with another project. Now, although we did not realize it at the time, our survey work was completed.

Leaving Little America on February 5 we attempted to reach the coast in the second survey area, between Mt. Siple and the Thurston Peninsula. After much punching into the now new-forming ice, and listening to the disappointing reports of returning reconnaissance flyers, we regretfully gave up and headed for Marguerite Bay on the Palmer Peninsula. Here we visited with the Ronne Expedition and his British neighbors at Grahamland. On February 28th we headed north, aiding Ronne's "Port of Beaumont" through the pack to open water; then leaving their slower craft, we set course for Peru and our first glimpse of civilization in four months.

## ANTARCTIC SURVEYING\*

*E. L. Merritt, U. S. Naval Photographic Interpretation Center*

MR. PRESIDENT, Ladies and Gentlemen, Guests, and Fellow Members: I don't know of a group of people to whom I would rather speak than the American Society of Photogrammetry, and I don't know of a subject I would rather speak on than surveying in Antarctica.

The accomplishment of any large survey operation is preceded by the development of an operational plan. Under normal circumstances this plan is based on facts determined from reconnaissance. Planning a survey operation without the benefit of reconnaissance and without a complete guide is very difficult, and is a tremendous responsibility when lives and equipment are involved in the execution of the operation. This is particularly true of a survey conducted in Antarctica. Generally, there is sufficient latitude and flexibility in a survey operation to permit errors in judgment without serious jeopardy to men, equipment, and over-all objectives. Where there are many unknown variables, it is necessary to anticipate, and therefore prepare for, an operation in its entirety, down to the most minute detail. This has been a fundamental principle with all explorers.

I want to emphasize at the start that our responsibility of making the survey observations was, relatively speaking, an easy one. It was not difficult primarily because of the precedents established by, and the sacrifices made by such men as Scott, Shackleton, Mawson, Amundsen, Wilkes, Admiral Byrd, and others. Moreover, if we had not had efficient, sturdy ice-breakers commanded by Naval Officers experienced in the lore of ice-navigation, we would never have cut the distance between ship and survey point down to the safe range of the helicopter. If we had not had helicopters aboard manned by skillful Naval pilots, at least half of the survey points would have been inaccessible to us by any other means of transportation.

With your permission I am going to digress a moment to bring out a point—a bit of fundamental philosophy that I believe is vividly embodied in the story of Antarctic exploration. The philosophy is this: The present state of knowledge embodies all the sacrifices and all the contributions of our predecessors. Our mission was made less difficult because of these sacrifices and these contributions.

Let us briefly review Antarctic exploration. Ross, figuratively and literally being the first to break through the Antarctic ice pack, blazed the trail to all subsequent observations of the Antarctic coastline. He established the precedent for navigating through the ice pack; and further, up to and including his date,

\* By permission of the Commanding Officer, U. S. Naval Photographic Interpretation Center. Paper read at American Society of Photogrammetry Annual Meeting, Washington, D. C., January 13, 1949.