

HOLMES & NARVER, Inc.
ENGINEERS-CONSTRUCTORS

408004

TO: S. P. Howell JOB: 942

FROM: L. S. Hammond RE: LOCAL HORIZONTAL CONTROL SURVEYS - ENIWETOK ATOLL

DATE: August 9, 1957

Reference is made to Field Sketches 6267 and 6268 delineating proposed local control surveys in the Ruby-Sally-Tilda area and in the Yvonne area. These sketches outline jobsite planning to provide sufficient controls in these areas to perform any requirements for layout of scientific stations. I concur in the proposed program but submit the following modifications which I believe will reduce the amount of field work required to provide controls consistent with project requirements.

1. In the Yvonne area, a traverse is proposed between triangulation station "Runit" and the new station "North". Intermediate monuments are proposed at approximately 200 meter intervals and all 50 meter chaining bucks are to consist of 4 x 4 posts set in concrete. I recommend that the monuments be set as proposed but that temporary chaining bucks be used for measurement of the traverse. Control points 200 meters apart should be sufficient for any needs and the expense of permanent points 50 meters apart could not be justified.

The measurement of the traverse should be performed to first order traverse specifications, or within a tolerance of 1:25000, and the resulting measurements adjusted between the established positions of stations Runit and North. Any refinement beyond first order traverse specifications would serve no purpose or the final values will be based on the established coordinates of the triangulation stations.

The triangle North-Traverse Station Ynez-Runit should be observed to second order observing procedure.

2. In the Ruby-Sally-Tilda area, the proposed traversing includes two triangles and connecting traverses. As in the Yvonne area, it should be sufficient to establish permanent monuments at 200 meter intervals rather than making all 50 meter chaining bucks permanent monuments. Traversing to first order traverse specifications should be satisfactory to meet any requirements in this area.

All angles involved in the traverses and including ties to the basic network should be to second order observing procedures.

The attached sketch indicates the recommended location of permanent monuments and the angles to be observed.

It should be recognized that this program is based on limited information by the Jobsite, or Home Office, as to the ultimate requirements for these areas. However, the proposal to establish these controls early, before a great increase in the survey work load can certainly be justified.

BEST COPY AVAILABLE

LSH:cw

cc: D. C. Van Dine
Engineering Files
L. S. Hammond

REPOSITORY Nevada Operations Office
COLLECTION 67 A 1016
BOX No. 223138 or ?
FOLDER Survey No. 1 (Proj. Engr. File)
April 10, 1954 to
Jan. 28, 1958

HOLMES & NARVER, Inc.
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TO: S. P. Howell JOB: 942 WHE
FROM: L. S. Hammond RE: Precise Surveys Bikini Atoll
DATE: July 31, 1957

Reference is made to J6-3816 w/encl. Secret, dated June 25, 1957, which specifies a first order horizontal and vertical inter-relation between scientific stations to be located on site HOW and a station on site NAN at Bikini Atoll. To provide this inter-relation to first order, procedures, would require an extensive horizontal control survey including a first order base line on HOW and a new lagoon station west of HOW. The following recommended procedures are based on modification of this requirement to specify that the inter-relation be determined to within a tolerance of 1:25,000, but eliminating the requirement for first order procedure.

- (1) Horizontal Control An evaluation of the existing network indicates that due to the strength of the original survey and the relatively small area involved, horizontal inter-relation within the tolerance of 1:25,000 can be accomplished in the following manner. This is on the assumption that stations North HOW, South HOW and NAN have not been disturbed.
 - (a) An adjustment by the method of least squares will be applied to the original 1953 survey, and to the 1955 expansion survey. This will determine the most probable values for the stations of the network, including the stations on HOW and NAN. The closing error of the original 1953 network, before adjustment, was better than 1:70,000 and a very low probable error was determined for the base line. With this strength it is safe to assume that the adjusted values for HOW and NAN will meet requirements of 1:25,000.
 - (b) The horizontal location of the primary working point on HOW will be determined by observing the triangle WP - North HOW - South HOW to first order procedures.
 - (c) The additional working points on HOW will be located by first order traverse procedures from these stations. The working point for the station on NAN will be located by the same procedures in reference to triangulation station NAN.

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- (2) Vertical Control The vertical inter-relation of stations on HOW and NAN will require an extensive survey, but can be accomplished to well within the tolerance of 1:25,000 and approaching first order leveling tolerances of 0.017 times the square root of the distance in miles. The following recommended procedures include reciprocal leveling over the water between islands and sand spits along the east reef.
- (a) The atoll chart indicates the possibility of observing between HOW and NAN by occupying eleven instrument stations. See attached sketch. A terminal point on HOW and on NAN, seven on existing sand spits or islands, and two on observing tripods which will be placed midway between land areas where the over water distance is excessive. These tripods will be similar to the observing tripods used on DOG and GEORGE during the CASTLE operation. They will be required in pairs approximately twenty feet apart.
 - (b) The required equipment will include a first order level equal to the Wild N 111, two Invar leveling rods and large targets of special design, which can be observed at long distances. This equipment is not available at the jobsite at this time.
 - (c) The leveling will be performed to procedures adopted by the U.S. Coast and Geodetic Survey and other organizations for leveling across stretches of water, with some modification to meet the problem of this operation.

A brief description of the method is as follows and more detailed procedures will be set up if a jobsite reconnaissance determines that the method is feasible.

Permanent bench marks are established at the seven land locations. Pairs of tripods at the two water locations. These tripods must be very stable. The observing is then accomplished between pairs of bench marks. The level is set up about twenty feet from the near bench mark and a backsight is taken on the near rod. Next, the telescope is focused on the distant rod with the bubble centered and the target is made to coincide with the middle wire. Radio communications will be required for this operation. Upon completion of the

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operation, the rodman loosens the target while the levelman throws the bubble off center. After a lapse of a few minutes, in order to allow a change in atmospheric conditions, the operation is repeated. This operation is repeated until a set of ten observations is secured. At no time during the distant rod observations may the focus of the telescope be changed.

The level is then moved carefully to the opposite end of the line where it is set up approximately twenty feet from the other bench mark and a set of ten reciprocal observations is taken on the distant rod. The level should be transported as rapidly as possible so that atmospheric conditions during the two sets of the observations will be the same, or similar and, in such a manner that the focus of the telescope and the adjustment of the level bubble are not changed. To ascertain that the focus of the telescope is the same for both sets of distant observations, the distant target upon the latter set up is read before the rear rod is observed.

The mean difference determined by the two sets will be free from the effect of level error, curvature and refraction if the atmospheric conditions are the same for both sets.

The mean value for the target observations is computed before the instrument is moved, so that doubtful observations may be rejected and replaced by new observations.

This entire operation is repeated across each stretch of water and connected by first order leveling across the land areas between bench marks.

The primary bench mark on NAN, established by tide gage observations, becomes the datum for the operation. First order leveling is accomplished between the primary bench mark and the new mark at the north end of NAN, and from the new mark at the south end of HOW to the scientific station locations on HOW.

As this program will require considerable time for scheduling and field work it is recommended that the proposed program be submitted to the jobsite for early reconnaissance and comments. If adopted, requisitions should be initiated for procurement of the required equipment.

LSH/hg

cc: D. C. VanDine
Engineering Files
L. S. Hammond

N. HOW



S. HOW



3000 ±

2500 ±

3750 ±

TRIPODS

3750 ±

3081 ±

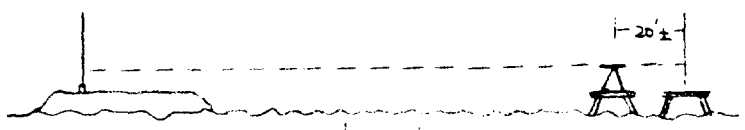
3700 ±

3400 ±

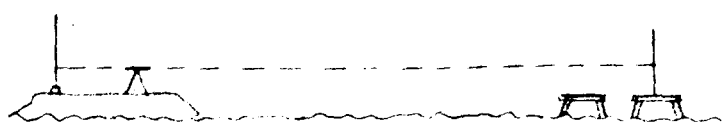
3400 ±

TRIPODS

3400 ±



2nd set



1st set

NAN