Kaena (Oahu Island, Hawaiian Government Survey, 1875).—About 800 feet back from the extremity of Kaena Point, the extreme northwest point of Oahu, in the center of a small area, surrounded by stone walls, said to have been a "helau." Marked by a concrete post projecting about 6 inches above the ground.

Station is destroyed. Also reported destroyed in 1952. Sand has been removed until the edge of the hill is 60 feet from Kaena Point Light. The station was located out from the edge about 30 feet, in the area that is now many feet lower than the top of the dune.

Detailed statement as to the status of the original description, including marks found, stampings, changes made, and other pertinent facts:

---

*Note of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

---

**Table:**

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>$\theta$ ($\Delta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>403176.76</td>
<td>169,283.50</td>
<td>0°06'13&quot;</td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the $x$-$y$, $x$, $y$ formula neglecting the second term.*

---

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEOGRAPHIC AZIMUTH (From north)</th>
<th>PLANE AZIMUTH (From north)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 387</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The station was recovered and found in good condition, however it is on the east side of the Kaena Point Light instead of the west side as stated in the first description. Two reference marks, numbers one and two, were established. A complete description follows:

Station is located on Kaena Point, the westernmost point of Oahu, at east side of lighthouse, on a prominent sand dune overlooking the rocky point about 200 yards west.

To reach station from the post office in Waialua, go south on Goodale Avenue for 0.1 mile; turn right and follow State Highway 99 west for 7.0 miles to Camp Erdman on the right. Continue west for 2.5 miles to fork opposite old beach shack. Take right fork before reaching dune. Walk west about 150 yards to top of dune and station. (NOTE: The road becomes very rough and almost impassable in wet weather, after leaving Camp Erdman).

Station mark is a 3 x 4-inch brass plate, stamped "US ENG ELEV", set in the top of a 6-inch-square, concrete post. It is in a small, open sand area surrounded by naupaka brush, 15.026 feet east of center of lighthouse and about 8 inches below surface of sand. A 1/4-inch brass plug projects 1/4-inch from the center of the brass plate.

Reference mark number one is a standard disk stamped "KAENA POINT USE NO 1 1914 1955", cemented in a drill hole in the northeast corner of the 9 x 9-foot, concrete foundation of the lighthouse. It is about 1 foot lower than station mark and covered with sand.

Reference mark number two is a standard disk stamped "KAENA POINT USE NO 2 1914 1955", cemented in a drill hole in the northwest corner of an old, 9 x 9, concrete foundation that sets at the north side of the lighthouse foundation. The mark is 0.3 feet north of the center of the lighthouse and about 1 foot lower than station mark.

(continued on next page)
HORIZONTAL CONTROL DATA

by the
NATIONAL GEOGRAPHIC SURVEY
OLD HAWAIIAN DATUM

KANIA POINT USE (continued)

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KANIA POINT (USE)
ESTABLISHED BY: U.S.N.E. YEAR: 1929
STATE: Hawaii
RECOVERED BY: G.A. Amnis YEAR: 1969
COUNTY: Honolulu
AIRCRAFT DISTANCE AND DIRECTION FROM NEAREST TOWN: 9 3/4 miles west of Waialua.

Detailed description as to the license of the original description: including marks found, engine, changes made, and other pertinent factors.

The station mark and reference marks 1 and 2 were recovered as described and found in good condition. The to reach is adequate for reaching the station. The 1969 observations follow:

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>BEARING</th>
<th>FEST</th>
<th>METERS</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>KAPHEH NW</td>
<td>1927°</td>
<td>11.92</td>
<td>3.633</td>
<td>0° 56' 40&quot;</td>
</tr>
<tr>
<td>RM 1°</td>
<td>WSW</td>
<td>19.53</td>
<td>9.916</td>
<td>315° 45' 01&quot;</td>
</tr>
<tr>
<td>Radar Dome</td>
<td>NW</td>
<td>15.86</td>
<td>5.328</td>
<td>155° 45' 01&quot;</td>
</tr>
</tbody>
</table>

No measurement was made between the reference marks due to a lighthouse on line.

U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

QUAD 211581 STATION 1052
LATITUDE 10° 10'
LONGITUDE 10° 10'

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KANIA POINT (USE)
ESTABLISHED BY: U.S. Engineers YEAR: 1914
STATE: Hawaii
RECOVERED BY: G.A. Amnis YEAR: 1970
COUNTY: Honolulu
AIRCRAFT DISTANCE AND DIRECTION FROM NEAREST TOWN: 9 miles west of Waialua.
HEIGHT OF TELESCOPE ABOVE STATION MARK: 31 feet.
HEIGHT OF LIGHT ABOVE STATION MARK: 31 feet.

DISTANCES AND DIRECTIONS TO Referenced MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>BEARING</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Mark No. 1</td>
<td>NW</td>
<td>19.53</td>
<td>5.986</td>
</tr>
<tr>
<td>Reference Mark No. 2</td>
<td>NW</td>
<td>11.92</td>
<td>3.634</td>
</tr>
<tr>
<td>Reference Mark No. 3</td>
<td>NW</td>
<td>19.53</td>
<td>5.982</td>
</tr>
</tbody>
</table>

Station and Reference Marks No. 1 and No. 2 were recovered. The recovery description of W.R. Porter, 1963 has the description of Reference Marks No. 1 and No. 2 reversed, but the box score in correct order. A distance in to reach did not check. The recovery description of G.A. Amnis, 1970 is in error in reporting the previous description as correct. A complete description follows:

Station is located on Kaniea Point, the westemmost point of Oahu, at the east side of the Lighthouse, on a prominent sand dune about 5 feet above sea level, about 200 yards east of the extreme rocky point of the Island.

To reach from the Post Office in Waialua, go south on Goodale Avenue for 0.5 miles, turn right and follow State Highway 79 west for 0.6 miles to Camp Erdman on the right, and further west 0.9 mile to the end of pavement, continue westly along coast road for 2.3 miles to a fork at the point where the power line begins heading to the south. Take the left fork and follow track road westerly for 0.4 miles to end of road in sand just before reaching dune. Walk west 100 yards to top of dune and station. (NOTE: The road is rough at points and becomes almost impassable in wet weather after end of pavement.)

Station mark is a 3/8 inch brass plate, stamped "US NAV ELEF," set in the top of a 3-inch concrete post. It is in a small, open sand area surrounded by brush, about 15 feet east of center of the Lighthouse and about 1 foot above surface of sand. A 1/2-inch brass ring projects 1 inch from the center of the brass plate.

Reference Mark No. 1 is a standard disk, stamped "KANIA POINT E11 No 1 1914 1963," cemented in a drill hole in the northwest corner of a sand foundation that sets at the north side of the Lighthouse foundation. The mark is about 15 feet north of the center of the Lighthouse and about 1 foot lower than station. The mark is clearly visible from the actual station location.

Reference Mark No. 2 is a standard disk, stamped "KANIA POINT E11 No 2 1914 1963," cemented in a drill hole in the southeast corner of the sand foundation of the Lighthouse. It is about 1 foot lower than station, covered with sand, and slightly battered.

USCGD, NOAA, ASHEVILLE
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KAENA POINT LIGHT
STATE: HAWAII
YEAR: 1927
SECOND ORDER

SOURCE: G-14543

GEODETIC LATITUDE: 21° 54' 38.9"N
GEODETIC LONGITUDE: 156° 16' 55.7"W
ELEVATION: 140 meters
SCALED 14 METERS

<table>
<thead>
<tr>
<th>STATE COORDINATES (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
</tr>
<tr>
<td>5103</td>
</tr>
<tr>
<td>40° 127.13</td>
</tr>
<tr>
<td>149,315.64</td>
</tr>
<tr>
<td>0° 06' 14&quot;</td>
</tr>
</tbody>
</table>

HORIZONTAL AXIS: HAS BEEN COMPUTED BY THE 2° 30" FORMULA NEGLIGEBLY THE SECOND TERM.

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEODETIC AZIMUTH (from north)</th>
<th>PLANE AZIMUTH* (from north)</th>
<th>CODES</th>
</tr>
</thead>
</table>

(continued on next page)
HORIZONTAL CONTROL DATA
by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

KAENA POINT LIGHT (continued)

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KAENA POINT LIGHT
ESTABLISHED BY: L.O.S.
YEAR: 1927 STATE: Hawaii
RECOVERED BY: W.R. Porter YEAR: 1963 COUNTY: Honolulu

HEIGHT OF TELESCOPE ABOVE STATION MARK 7.2 METERS
HEIGHT OF LIGHT ABOVE STATION MARK METERS

DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>MEASURED</th>
<th>DISTANCE</th>
<th>MEASUREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BATH 1932</td>
<td>E</td>
<td>15,026</td>
<td>4,560</td>
</tr>
<tr>
<td>KAENA POINT (URE) 1914</td>
<td>W</td>
<td>204,869</td>
<td>62,444</td>
</tr>
<tr>
<td>Boundary Mark (drillhole)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Station was recovered and found in good condition. The drill hole in which one of the 3 boundary marks was set, was recovered. There is cement around the hole but the mark has been removed. The other two boundary marks, with no distances recorded, were not searched for. A complete description follows:

Station is located on Kaena Point, the westernmost point of Oahu, on a prominent sand dune about 50 feet above sea level, about 200 yards east from the extreme rocky point of the island.

To reach station from the post office in Wai'alu, go south on Goodale Avenue for 0.5 mile; turn right and follow State Highway 99 west for 7.0 miles to Kamp Erdman on the right. Continue west, along coast-line, for 5.6 miles to fork opposite old beach shack. Take right fork and follow old track road westward for 0.8 mile to end of road in sand just before reaching dune. Walk west about 150 yards to station. (NOTE: The road becomes very rough, and almost impassable in wet weather, after leaving Camp Erdman.)

Station is center of Kaena Point Lighthouse; a 4-foot-square, concrete structure, painted white, and tapering slightly to the wooden platform which is 16 feet above ground. A clear glass light, 1.6 feet long and 1 foot diameter, sets on a base above the platform. Top of light is 20-1/8 feet above ground. The lighthouse sets on a 9-foot-square, concrete foundation. A similar concrete foundation is at the north side of the lighthouse.

The boundary mark drillhole is a 1-inch-diameter hole in the top of a round-topped boulder on the west slope of the dune. It is in a group of boulders, projects about 3 feet above ground, and is 24.72 feet lower than base of lighthouse.

*Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOTE - One of these forms must be used for every station recovered.

USCG-NOAA-ASHVILLE
HORIZONTAL CONTROL DATA

PUEO (Hawaii, H.A.P., 1932) -- About 3/4 mile E of Kaena Point, on the N side of the ridge, about 270 meters NW of the knob known as Puu Pueo, and on a narrow shoulder about 300 meters E of Kaena Point. This station serves all shore stations to land. Stations and R.M.s 1 and 2 are standard disks set in concrete in depressions in overtopping bedrock.  

OBJECT: DISTANCE DIRECTION
KAENA PT. L.T. meters 0°00'00"00"
R.M. 2 10.26 225 07 20
R.M. 1 8.90 255 27 00
Height of signal above station mark - 3 meters.
Height of instrument above station mark - 1.5 meters.

ADJUSTER: R. W.

ADJUSTMENT OF TRIANGULATION STATION

NAME OF STATION: PUEO
STATE: HAWAII
YEAR: 1932
SECOND ORDER

SOURCE: 0-14543

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PUEO
STATE: HAWAII
YEAR: 1932
SECOND ORDER

SOURCE: 0-14543

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PUEO
STATE: HAWAII
YEAR: 1932
SECOND ORDER

SOURCE: 0-14543

STATE COORDINATES (Feet)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (HDL. X ANG. 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>407,782.56</td>
<td>148,943.59</td>
<td>-0° 05' 56&quot;</td>
</tr>
</tbody>
</table>

* PLANE APROMOTH WAS COMPUTED BY THE 2 HDL. X FORMULA OMITTING THE SECOND TERM

TO STATION OR GAUGE

<table>
<thead>
<tr>
<th>GEODETIC APROMOTH (From code)</th>
<th>Plane Apromoth (From code)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KAENA POINT USE</td>
<td>95°46' 44&quot;0'</td>
</tr>
<tr>
<td></td>
<td>95°52' 43&quot;</td>
</tr>
</tbody>
</table>

THIS DATA OBTAINED FROM ADJUSTMENT OF NOV 1970
POSITION DETERMINED BY TRAVERSE FROM STATION KAENA PT USE
AND CHECKED BY ADDITIONAL OBSERVATIONS

DM 079

(continued on next page)
HORIZONTAL CONTROL DATA
by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PURUO
RECOVERED BY: B.G. Rushford
YEAR: 1964
STATE: Hawaii
COUNTY: Honolulu
HEIGHT OF TELESCOPE ABOVE STATION MARK: 0.52 METERS
HEIGHT OF LIGHT ABOVE STATION MARK: 0.52 METERS

DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION:

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>Bearing</th>
<th>Distance</th>
<th>Azimuth</th>
</tr>
</thead>
<tbody>
<tr>
<td>XANA POINT LIGHT 1927</td>
<td>SE</td>
<td>51.565</td>
<td>15.718</td>
</tr>
<tr>
<td>R.M. No. 1</td>
<td>S</td>
<td>29.150</td>
<td>8.885</td>
</tr>
</tbody>
</table>

Station was recovered and all marks found in good condition. A complete description follows:

Station is located about 3/4 mile east of Xana Point, at about 700 feet elevation, on a rock point along north side of ridge, about 270 yards northwest from Radar building No. 41 and 90 yards northwest from the terminal platform of an old WW-II aerial tram.

To reach station from the post office in Hala, go north on Farrington Highway for 6.1 miles to a macadam road on the left. Follow this road on up ridge for 2.0 miles to top of ridge and a guard box near the top of ridge. Turn left and follow macadam road along ridge for 2.0 miles to point at Building No. 1. Pack down ridge northwesterly for about 270 yards to station.

Station mark is a standard disk stamped "FUEO 1927", cemented in a drill hole in a 2 x 5-foot bedrock outcrop that projects 6 inches above ground. It is about 10 feet south from extreme edge of rock point.

Reference mark number one is a standard disk stamped "FUEO NO 1", cemented in a drill hole in a bedrock outcrop that projects 2 inches above ground. It is 6 feet east of bluff edge and 1.9 feet higher than station mark.

Reference mark number two is a standard disk stamped "FUEO NO 2", cemented in a drill hole in a 3-foot diameter, boulder, flat-topped boulder that projects 1-3/4 feet above ground. The boulder is rimmed by a semi-circle, about 15 feet in diameter, of whitish boulders, generally 3 to 4 feet higher than the mark. The mark is 3.5 feet higher than station mark.

NOTE: A difference in the distance and angle to reference mark number two was noted and checked in the field. It is believed that the boulder the mark is in has settled downhill.

The station mark and both reference marks were recovered and found to be in good condition. A slight difference was found in the distance and direction to both reference marks, from what was recorded in 1964.

Recovery Note, Triangulation Station

NAME OF STATION: PURUO
RECOVERED BY: B.G. Rushford
YEAR: 1964
STATE: Hawaii
COUNTY: Honolulu
HEIGHT OF TELESCOPE ABOVE STATION MARK: 5 FEET
HEIGHT OF LIGHT ABOVE STATION MARK: 4 FEET

DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION:

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>Bearing</th>
<th>Distance</th>
<th>Azimuth</th>
</tr>
</thead>
<tbody>
<tr>
<td>XANA POINT LIGHT 1918 &amp; 1919</td>
<td>SE</td>
<td>51.94</td>
<td>15.718</td>
</tr>
<tr>
<td>R.M. 2</td>
<td>S</td>
<td>29.17</td>
<td>8.885</td>
</tr>
</tbody>
</table>

The station is located about 9 1/4 miles west of Hala, 8 miles north-northwest of Waikiki, 3/4 mile east of Xana Point and 90 yards west of the platform of an old aerial tram, on the northwest of a ridge.

To reach the station from the post office in Hala, go north on State Highway 90 for 7.0 miles to a macadam road on the right. Continue ahead on State Highway 90 for 2.3 miles to a side road right and sign "Restricted Area-United States Air Force Space and Missile Systems". Turn right on asphalt road, keep up steep hill, for 2.0 miles to a "T" road intersection and guard gate on the left. (Stop at guard shack for clearance.) Turn left, northwest on asphalt road for 2.0 miles to the end of the road, a building on the left and triangulation station PAD. Pack west along ridge through brush to the remains of some old buildings. Here bear right, leaving top of ridge, and pick way down to the rock ledge and the station.

The station mark is a standard disk, stamped FUEO 1932, cemented in a drill hole in a boulder which projects about 2 inches above the ground surface. It is about 90 yards west of the platform of an old aerial tram and 16 feet southeast of the edge of the rock ledge.

Reference mark 1 is a standard disk, stamped FUEO NO 1, cemented in a drill hole in bedrock which projects about 2 inches above the surface. It is about 6 feet east of the edge of the ledge and about 2 feet higher than the station.

Reference mark 2 is a standard disk, stamped FUEO NO 2, cemented in a drill hole in a boulder which is about 3 feet in diameter and projects about 16 inches. It is a flat topped boulder, brown in color and about 3 1/2 feet higher than the station.

Triangulation station PAD is only about 1/4 mile from this station, therefore no azimuth mark is needed.

No measurement between reference marks due to rough terrain.
HORIZONTAL CONTROL DATA

DEPARTMENT OF COMMERCE
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HAWAII

by the National Ocean Survey
OLD HAWAIIAN DATUM

JUN 1979

U S DEPARTMENT OF COMMERCE

NAME OF STATION: RAD

STATE: HAWAII

COUNTY: Honolulu

CHIEF OF PARTY: R.E. Joffe

YEAR: 1958

Description by L. Wakefield

HEIGHT OF TELESCOPE ABOVE STATION MARK: 6 METERS
HEIGHT OF LIGHT ABOVE STATION MARK: 7.6 METERS

DISTANCES AND DIRECTIONS TO ADJACENT MARKS, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>MEASURING</th>
<th>DISTANCE</th>
<th>DEGREES</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANINI 1952</td>
<td>E</td>
<td>30.89</td>
<td>9.445</td>
</tr>
<tr>
<td>MODEL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The station is on Kaena Point, Oahu Island, Hawaii, about 2.8 miles southwest of the west end of the Bellingham airforce runway, and about 1.6 miles east of the Point Kaena Light house.

To reach the station from the post office in Waimanalo go west and north for 0.2 miles to the end of the pavement and a cemetary on the right constricted ahead 0.5 mile to a T-intersection, turn right and follow the winding road up the hill 1.6 miles to the top and a T-intersection, turn left on graded road and go 0.7 miles to the radar station on the left.

The station is standard disk tower, 1958 is set in a drill hole in the radar tower floor, excess is bored through a door which is kept locked.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: RAD

STATE: HAWAII

YEAR: 1958

SECOND ORDER

SOURCE:

G-14543

DEGREES AND DISTANCES

<table>
<thead>
<tr>
<th>DEGREES</th>
<th>DISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 34' 20.23309</td>
<td>409.828.42</td>
</tr>
<tr>
<td>158 15' 55.33306</td>
<td>952</td>
</tr>
</tbody>
</table>

ADJUSTED COORDINATES (EPS2000)

<table>
<thead>
<tr>
<th>STATE &amp; CODE</th>
<th>H</th>
<th>V</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>409.828.42</td>
<td>147.9 + 13.70</td>
</tr>
</tbody>
</table>

THESE DATA OBTAINED FROM ADJUSTMENT OF NOV 1970

POSITION DETERMINED BY TRAVERSE FROM STATION KEPUHI NEW

AND CHECKED BY ADDITIONAL OBSERVATIONS

(continued on next page)
RECOVERY NOTE, TRIANGULATION STATION

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>Bearing</th>
<th>Distance</th>
<th>Height</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEPUNI NEW 1927</td>
<td>W</td>
<td>42.89</td>
<td>13.074</td>
<td>0 08 00.0</td>
</tr>
<tr>
<td>Point A</td>
<td>SE</td>
<td>81.89</td>
<td>26.958</td>
<td>90 15 13.3</td>
</tr>
<tr>
<td>Reference mark</td>
<td>S</td>
<td>31.00</td>
<td>9.447</td>
<td>355 06 13</td>
</tr>
<tr>
<td>Keana Pt. Radio Mast</td>
<td>S</td>
<td>1 mile</td>
<td>320</td>
<td>51 3 46.6</td>
</tr>
</tbody>
</table>

MODEL 1958

Station mark was recovered and found to be in good condition. The radar tower mentioned in the 1958 description is no longer at the station site. Station MODEL 1958 and reference mark 3 were observed for reference points. The distance to MODEL 1958 was checked and found to be correct.

Temporary point A was used for position check from KEPUNI NEW 1927. Goodmeter traverse was made to KEPUNI NEW 1927 from the station and point A.

A new description follows:

Station is located about 8 miles north of Makaha and 2 miles south-southeast of the Keana Point Lighthouse at the U.S. Air Force Keana Point Satellite Tracking Station just south of building number 35. To reach from the Keana Point Satellite Tracking Station guard gate, go northwesterly on surfaced road for 1.6 miles to building number 35 and station on the left.

Station mark, a standard disk stamped RAD 1958, is set in a drill hole in a 6 foot square concrete slab. The mark is 96 feet north of a power line pole, 81.5 feet southwest of center of gate and 48 feet south of the southeast corner of building number 35. MODEL 1958, a standard disk stamped MODEL 1958, is set in a drill hole in the southeast corner of a large concrete slab. The mark is 90 feet southwest of center of gate, 48 feet northwest of a power line pole, and 66 feet south of the southeast corner on building number 35.

Reference mark, a standard disk stamped MODEL NO 1 1958, is set in a drill hole in a 3 foot square slab. The mark is 77 feet southwest of center of gate and 31 feet northeast of power line pole.
**HORIZONTAL CONTROL DATA**

**DESCRIPTION OF TRIANGULATION STATION**

- **Name of Station:** MODEL
- **State:** HAWAII
- **County:** Honolulu
- **Chief of Party:** E.E. Jones
- **Year:** 1958
- **Datum:** OLD HAWAIIAN DATUM
- **Latitude:** 21° 30' to 22° 00'
- **Longitude:** 158° 00' to 158° 30'

**Adjusted Horizontal Control Data**

- **Model:**
  - **State:** HAWAII
  - **Year:** 1958
  - **Second Order**
  - **Group:**

<table>
<thead>
<tr>
<th>Source</th>
<th>21°34'19.94287</th>
<th>158°15'55.17691</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEGREES</td>
<td>SCALED 290</td>
<td>METERS</td>
</tr>
<tr>
<td>E</td>
<td>409,843.11</td>
<td>147,386.41</td>
</tr>
<tr>
<td>N</td>
<td>51.03</td>
<td>-0°05'51&quot;</td>
</tr>
</tbody>
</table>

**Detailed Statement:**

The station is on Keana Point, Oahu Island, Hawaii, about 2.8 miles south-east of the west end of the Bellingham Airforce Base runway, and 1.6 miles east of Keana Point Lighthouse.

To reach the station from the post office in Waianae, go west and north for 6.9 miles to the end of the pavement and a cemetery on the right, continue straight ahead 1.5 miles to a T-intersection, turn right and follow the winding road up steep hill for 1.6 miles to the top and a T-intersection turn left and go 1.7 miles to the station on the left at the radar station.

The station a standard disk named MODEL 1958 is set in a drill hole in the large concrete platform at the side of the radar station about 25 feet east and in front of the door leading into the tower, and 1.0 feet west of the edge of the platform.

**Recovery Note, Triangulation Station**

- **Rank of Station:** MODEL
- **Established by:** E.E. Jones
- **Year:** 1958
- **State:** Hawaii
- **Recovered by:** D.G. Rushford
- **Year:** 1964
- **County:** Honolulu

**Detailed Statement:**

Station mark was recovered in good condition as described in 1958.

**Additional Observations:**

These data obtained from adjustment of OCT 1971 position determined by traverse from station RAD and checked by additional observations.

**Recovery Note:**

- **Code:** QM 081
HORIZONTAL CONTROL DATA

QUAD 211581 STATION 1057
HAWAII
LATITUDE 21°30' to 22°00'
LONGITUDE 158°00' to 158°30'
DIAGRAM NO. 4.11 OHU

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KAENA POINT RADAR DOME
STATE: HAWAII
YEAR: 1969
Third Order

DESCRIPTION OF TRIANGULATION INTERSECTION STATION

NAME OF STATION: KAENA POINT RADAR DOME
CHIEF PARTY: C.A. Annis
YEAR: 1969
STATE: HAWAII
COUNTY: Honolulu

Description, including sketch of object:
The station is a small round ball on the top of the big radar dome, located on Instrumentation Sqn Keana Pt. Tracking Station 6593 Rd. Systems OHQ. It is a standard US Air Force Radar Dome 100 feet in diameter and 130 feet high.

STATE CODES

STATE & CODE X Y Z
MI 5 416,793.26 144,999.07 0°05'24"
NAME OF STATION: KAENA POINT RADIO MAST

CHIEF OF PARTY: C.A. Annis
YEAR: 1969
STATE: Hawaii
COUNTY: Honolulu

DESCRIPTION: The station is the red light on top of the mast, located at Kaena Point on Instrumentation SQDN Kaena Fts. Tracking Station 6593 Rd. Systems G86. It is a standard radio mast painted red and white with 3 small cross bar antennas at the top and it is 300 feet high.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KAENA POINT RADIO MAST
STATE: Hawaii
YEAR: 1969

DESCRIPTIVE LATITUDE: 21° 33' 54.81859
DESCRIPTIVE LONGITUDE: 158° 15' 02.84543
ELEVATION: METERS

STATE Coordinates (wgs84):

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5135</td>
<td>414,778.59</td>
<td>144,841.20</td>
<td>- 0 09' 32'</td>
</tr>
</tbody>
</table>

Plane azimuth has been computed by the \( \phi \cdot \cos \cdot \Delta \) formula neglecting the second term.

TO STATION OR OBJECT

<table>
<thead>
<tr>
<th>GEODETIC AZIMUTH</th>
<th>PLANE AZIMUTH</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>QM 083</td>
</tr>
</tbody>
</table>
Makua (U.S. E.) (Oahu Island, L. G. Simmons, 1927).—The old Army mark of 1914 was recovered in 1927. It consists of a 2-inch gas pipe driven in the ground, and is about 70 yards up the ridge from Makua B, in azimuth 127° 20'.

Recovery Note. Triangulation Station

The station was not recovered. It was previously described as being a pipe driven into the ground.

STATE COORDINATES (Ft)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (W.D) (H. A. AMEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>422,737.00</td>
<td>129,138.49</td>
<td>- 0° 05' 00&quot;</td>
</tr>
</tbody>
</table>

*Plane Azimuth has been computed by the formula neglecting the second term.

CODE: 0-14543
Makua 2 (Oahu Island, L. G. Simmons, 1927).—On western coast of Oahu, about 1 mile south of Makua railroad station, on the first ridge south of Makua railroad station, on west end of ridge, and about 1/2 mile from shore line. The old Army station, Makua (U. S. E.), is about 70 yards up the ridge, in azimuth 127° 25'. Station marked according to note 2, a standard disk station mark in concrete, oblong bedrock. Reference marks, note 12a. standard reference marks in outcropping bedrock, are at the following distances and azimuths from station: No. 1, 8.768 meters (28.83 feet), 318° 20'; No. 2, 8.490 meters (27.87 feet), 318° 20'. There is a 2-inch gas pipe 12,340 meters (40.78 feet) from station in azimuth 318° 23'. Re-marked according to note 14x in 1929.

Recovery note, triangulation station

<table>
<thead>
<tr>
<th>NAME OF STATION</th>
<th>MAKUA 2</th>
<th>YEAR</th>
<th>1927</th>
<th>FIRST</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECOVERED BY</td>
<td>D. G. Rushford</td>
<td>1964</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CITY</td>
<td>Honolulu</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATE</td>
<td>Hawaii</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RECOVERY REPORT**

<table>
<thead>
<tr>
<th>HEIGHT OF TELESCOPE ABOVE STATION MARK (METERS)</th>
<th>HEIGHT OF LIGHT ABOVE STATION MARK (METERS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.M. No. 1</td>
<td>186.65</td>
</tr>
<tr>
<td>R.M. No. 2</td>
<td>177.76</td>
</tr>
<tr>
<td>Gas Pipe</td>
<td>20.765</td>
</tr>
<tr>
<td>R.M. No. 1 (1964)</td>
<td>186.614</td>
</tr>
<tr>
<td>R.M. No. 2 (1964)</td>
<td>177.767</td>
</tr>
<tr>
<td>Gas Pipe (1964)</td>
<td>20.760</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DISTANCE AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARK AND DISTRACTION OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.M. No. 1 (1927)</td>
</tr>
<tr>
<td>R.M. No. 2 (1927)</td>
</tr>
<tr>
<td>Gas Pipe (1927)</td>
</tr>
<tr>
<td>R.M. No. 1 (1964)</td>
</tr>
<tr>
<td>R.M. No. 2 (1964)</td>
</tr>
<tr>
<td>Gas Pipe (1964)</td>
</tr>
</tbody>
</table>

Station was recovered and all marks found in good condition. A complete diagram follows:

Station is located about 3-1/2 miles north of Makanuva village, at the southwest corner of Makanuva Valley, 1/4 mile east of State Highway 90 and Kaneohe Cave, on a brushy knoll about 995 feet below the west end of the prominent ridge. To reach station from the shopping center at Makanuva village, go north on State Highway 90 for 5.4 miles to a track crossing at south side of old cemetery, just after crossing bridge. Turn right and follow main track road southeast along base of ridge for 0.4 mile to end of truck travel at parking area on right. Park southerly up side of ridge to station. About a 20-minute walk. Station mark is a standard disk stamped "MAKUA 2 1927," cemented in a drill hole in a red bedrock outcrop about 40 feet northeast from the highest part of the knoll.

Reference mark number one is a standard disk stamped "MAKUA No. 1," cemented in a drill hole in the southeast end of a gray bedrock wall that is 2-1/2 feet high and 12 feet long and is the most prominent rock on the hill. The mark is about 4 feet higher than station mark.

Reference mark number two is a standard disk stamped "MAKUA No. 2," cemented in a drill hole in an outcropping bedrock point that projects 2 feet above the general ledge line on northeast side of hill. The mark is about 1-1/2 feet lower than station mark.

Gas pipe is a 2-inch, iron pipe that projects about 1 foot from the ground. It is 4 feet southeast from the southeast end of the rock wall that R.M. 1 is in, and about 3 feet higher than station mark.

(continued on next page)
### Recovery Note, Triangulation Station

**NAME OF STATION:** MAKUA 2  
**MARKED BY:** L.O.S.  
**YEAR:** 1927  
**STATE:** HAWAII  
**BENCH MARKS:**  
**RECOVERED BY:** C.A.A.  
**YEAR:** 1969  
**COUNTY:** Honolulu  
**AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN:** 3 1/2 miles north of Makaha

Detailed statement as to the fitness of the original description, including marks found, changes made, and other pertinent facts:

The station mark and both reference marks were recovered as described and found to be in good condition. The station was reached by helicopter at this time therefore the "to reach" was not checked. A slight difference was found in the distance to both reference marks and the new distance and direction to both are listed below.

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>BEARING</th>
<th>FEET</th>
<th>METERS</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>KAHUA POINT 1914 1919 (USE)</td>
<td>E</td>
<td>17.78°</td>
<td>5,917</td>
<td>000 00.00</td>
</tr>
<tr>
<td>B.M. 2</td>
<td>SE</td>
<td>26.80°</td>
<td>6,779</td>
<td>136 22.22</td>
</tr>
<tr>
<td>B.M. 1</td>
<td>NW</td>
<td>(Approx. 5 1/2 ml)</td>
<td>359 58 36.1</td>
<td></td>
</tr>
</tbody>
</table>
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

QUAD 211581 STATION 1001
HAWAII
LATITUDE 21° 30' TO 22° 00'
LONGITUDE 158° 00' TO 158° 30'
DIAGRAM NF 411 OAHU

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: BENCHMARK K 3
STATE: HAWAII
YEAR: 1969
SECOND ORDER

SOURCE: G-16543

GEODETIC LATITUDE: 21°30'13.613032
GEODETIC LONGITUDE: 158°13'56.956601
ELEVATION: 5.22 FEET
174 FEET

STATE COORDINATES (X/Y/Z)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z-WHD AT WRLD'</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>420,964.67</td>
<td>122,511.86</td>
<td>- 3'05.07'</td>
</tr>
</tbody>
</table>

* PLANET AZIMUTH HAS BEEN COMPUTED BY THE FORMULA REFLECTING THE SECOND TERM

TO STATION OR OBJECT GEODETIC AZIMUTH PLANET AZIMUTH* CODE

| MAKUA 2 | 197°03'56.7 | 197°08'45" | 5103 |

POSITION DETERMINED BY TRAVERSE FROM STATION MAKUA 2
AND CHECKED BY ADDITIONAL OBSERVATIONS

QH 086
HORIZONTAL CONTROL DATA

DESCRIPTION OF BENCHMARK

State Hawaii
County Honolulu
District and direction from nearest town 9.35 miles northwest
Established by State of Hawaii
Detailed description

9.35 miles northwest along State Highway 90 from the
post office at Waianae, at the crossing of a power line, 0.05 mile
southeast of the junction of a paved road northeast to Kamehameha T.
Track Station, at the southeast end of a turnout, in the top of
a lava rock projecting 0.3 foot above the ground which is at the
northeast end of a cut, 22.7 feet southwest of the center line of
the highway, 16.0 feet north of power pole 244, 15 feet northeast
of the southwest ledge of a cliff, about level with the highway and
25 feet higher than the ocean.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: STATE SURVEY 8-3
STATE: HAWAII
YEAR: 1969
SECOND-ORDER

OBSERVATION CHECK ON THIS POSITION

<table>
<thead>
<tr>
<th>Geodetic Latitude</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>21°32'55&quot;56'089&quot;</td>
<td>8.24 Meters</td>
</tr>
<tr>
<td>158°14'34&quot;39'337&quot;</td>
<td>27.0 Feet</td>
</tr>
</tbody>
</table>

STATE COORDINATES (feet)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Code</th>
<th>U</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>417,454.91</td>
<td>138,897.96</td>
</tr>
</tbody>
</table>

* Plane azimuth has been computed by the F . H. O. T. formula neglecting the second term.

TO STATION OR OBJECT

<table>
<thead>
<tr>
<th>Station</th>
<th>Geodetic Azimuth</th>
<th>Plane Azimuth</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAKUA 2</td>
<td>330°53'56.5&quot;</td>
<td>330°59'18&quot;</td>
<td>5103</td>
</tr>
</tbody>
</table>

POSITION DETERMINED BY TRAVERSE FROM STATION MAKUA 2

QH 085
HORIZONTAL CONTROL DATA

DESCRIPTION OF BENCHMARK

Name of Station: STATE SURVEY 8-10
State: Hawaii
County: Honolulu
State Highway: 90

Discussion:

7.8 miles northwest along State Highway 90 from the
post office at Waianae, 0.2 mile north of the junction of a road
northwest, along the east shoulder of the highway, 15.9 feet east
of the center line of the highway, 250.0 feet south of the center
line of a gravelled road west to a beach, 428 feet south of the
south end of the west head wall of a culvert, about level with
the highway, and set in the top of a concrete post.

ADJUSTED HORIZONTAL CONTROL DATA

Source:

G-14543
NO OBSERVATION CHECK ON THIS POSITION

Geodetic Lat.: 21°31'55.2465"
Geodetic Long.: 158°13'49.11383"
Elevation: 5.37 Meters
475.0 Feet

State Coordinates (Hawaii):

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X (Feet)</th>
<th>Y (Feet)</th>
<th>D (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>421,720.40</td>
<td>132,765.58</td>
<td>-0 05 04</td>
</tr>
</tbody>
</table>

"PLANE AZIMUTH HAS BEEN COMPUTED BY THE A + DNI FORMULA NEGLECTING THE SECOND TERM.

To Station or Object: NAKUA 2

Geodetic Azimuth (from point): 341°54'55.4"
Plane Azimuth (from point): 341°54'60"
Code: 5103

Position determined by Traverse from Station NAKUA 2
HORIZONTAL CONTROL DATA

The station is the red light on top of the tower, which is located about one and one-half miles northeast of Wahiawa on the Naval Reservation, about 200 feet north of the gate. It is a three-legged red-and-white tower about 200 feet high. There are two radar dishes on top of the tower.

Description of Triangle Intersection Station

NAME OF STATION: Wahiawa USN COMM STA TOWER

Chief of Party: Carl A. Annis

YEAR: 1969

STATE: Hawaii

COUNTY: Honolulu

The station is the red light on top of the tower, which is located about one and one-half miles northeast of Wahiawa on the Naval Reservation, about 200 feet north of the gate. It is a three-legged red-and-white tower about 200 feet high. There are two radar dishes on top of the tower.

Source: G-14543

Geodetic Latiude: 21°31'09.00"
Geodetic Longitude: 158°00'30.86718"

Elevation: Meter

State Coordinates (FIPS)

STATE & ZONE CODE X Y E (H.O. 61 ANGLE)
HI 3 5103 497.085.47 128.054.68 0'00'11"

Plane Azimuth has been computed by the following formula neglecting the second term.

To Station or Object

Geodetic Azimuth

Plane Azimuth

Code

QM 091
HORIZONTAL CONTROL DATA

NAME OF STATION: WAIANA USN COMM STA RADAR DISH


Description, including sketch of object:
The station is the top of the pedestal at the base of the radar dish, located 1.5 miles northeast of the village of Wahiawa on the Naval Reservation and in the southwest section of the reservation. It is a standard radar dish that is about 40 feet high.

JUN 1978
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

SURVEYED BY

by the National Ocean Survey
OLD HAWAIIAN DATUM

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: WAIANA USN COMM STA RADAR DISH

State: Hawaii  Year: 1969  Third

Source: G-14543

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>&quot;X&quot;</th>
<th>&quot;Y&quot;</th>
<th>&quot;Z&quot;</th>
<th>&quot;P&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>283.49</td>
<td>193</td>
<td>-0 00' 26&quot;</td>
<td></td>
</tr>
</tbody>
</table>

PLAN AZIMUTH HAS BEEN COMPUTED BY THE P" = "P FORMULA REFLECTING THE SECOND TERM.

TO STATION OR OBJECT

GEODETIC AZIMUTH

PLAN AZIMUTH

CODE

OHN 092
DESCRIPTION OF TRIANGULATION INTERSECTION STATION

NAME OF STATION: WHITMORE MIL RES DOUBLE TANK

CHIEF OF PARTY: Carl A. Annis Year: 1969

STATE: Hawaii COUNTY: Honolulu

The station is the red light in the center of the tanks, which are located on the military reservation, 1.7 miles northeast of Halamano School, just east of the headquarters building for the US Army Pacific Security Agency. The tanks are supported by a six-legged steel structure, and are about 140 feet high.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: WHITMORE MIL RES DOUBLE TANK

STATE: Hawaii YEAR: 1969

SOURCE: G-14543

<table>
<thead>
<tr>
<th>Geodetic Latitude</th>
<th>21°32'36.76835</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geodetic Longitude</td>
<td>158°01'10.77434</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>θ(°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>493,318.47</td>
<td>126,847.10</td>
<td>0'00'26&quot;</td>
</tr>
</tbody>
</table>

*PLANE AZIMUTH HAS BEEN COMPUTED BY THE Σ² METHOD FORMULA REFLECTING THE SECOND EQUATION.*
HORIZONTAL CONTROL DATA

NO ORIGINAL TEXT

Waialua Sugar Co. Mill Stack (Honolulu, Co., Hawaii, O.B.P., 1910; I.G.S., 1927).—Center of large steel smokestack on Waialua sugar mill. This was called station MIU in 1910.


Data of chimney: Was constructed in 1900 to a height of 185 feet. 30 feet has been taken off the top and consequently it now stands to a height of 150 feet. The diameter at the top is 11.8 feet. It is constructed of steel with a brick lining.

The chimney was recovered as described.

The intersection station was recovered in good condition as described.

---

ADJUSTED HORIZONTAL CONTROL DATA

<table>
<thead>
<tr>
<th>NAME OF STATION</th>
<th>MAIALUA SUGAR CO MILL STACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE</td>
<td>HAWAII</td>
</tr>
<tr>
<td>YEAR</td>
<td>1910</td>
</tr>
<tr>
<td>THIRD ORDER</td>
<td>R</td>
</tr>
<tr>
<td>SOURCE</td>
<td>6-14543</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STATE COORDINATES (FWS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE &amp; ZONE</td>
</tr>
<tr>
<td>HI 3</td>
</tr>
</tbody>
</table>

\[ z \text{ plan correction} = 2(\text{correction for } x \text{ and } y) \]

 THESE DATA OBTAINED FROM ADJUSTMENT OF OCT 1971
ALEI (Hawaii, H.A.P., 1932)—Station is 2-2/3 miles E of Keena Point near edge of cliff at Alei Fall. A prominent rock (elevation about 800 feet) projects out from bluff about 0.3 mile NW of station. Station and R.M. 1 and 2 are standard disks set in concrete in depressions in boulders. This station can be reached by the trail up to station KAHAU and then up gulches.

This station sees stations MATH and PERD.

SUBJECT AND GEODETIC SURVEY

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: ALEI

ESTABLISHED BY: H.A.P.

YEAR: 1932

STATE: Hawaii

COUNTY: Honolulu

HEIGHT OF STATION ABOVE MSL: 1,600 FEET

HEIGHT OF GROUND: 1,600 FEET

DISTANCES AND DIRECTIONS TO ADJACENT MARKS AND REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>BEARING</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock 1032</td>
<td>NNE</td>
<td>20,997</td>
<td>00 00 00.0</td>
</tr>
<tr>
<td>R.M. No. 2</td>
<td>NW</td>
<td>8,853</td>
<td>00 47 40</td>
</tr>
<tr>
<td>R.M. No. 1</td>
<td>SW</td>
<td>50,760</td>
<td>15,476 00 00 00.0</td>
</tr>
</tbody>
</table>

Station was recovered and all marks found in good condition. A complete description follows:

Station is located about 2-3/4 miles east of Keena Point and 1 mile west-southwest of Camp Erdman, at edge of bluff above Alei Fall. It is at the west side of a deep ravine and on the northeast corner of the broad flat-topped ridge that lies along the northeast side of Manini Gulch. To reach station from the post office in Wai'anae, go north on State Highway 90 for 9.1 miles to paved side road right. Turn right and go 2.0 miles to top of hill and T-junction at guard shack. Turn right and go 0.6 mile; take right fork and follow track road down-grade, crossing canyons and going up other side, for 0.9 mile to top of ridge. Turn sharp left and go down along ridge for 0.45 mile to fork. Take right fork over top of ridge for 0.3 mile to dim fork. Keep ahead left fork for 0.4 mile to fork at scarp of rock. Take right fork and keep portion along south edge of ridge top, through grass and brush, for 0.1 mile to end of hill and station. (A 4-wheel-drive vehicle is required.)

Station mark is a standard disk stamped "ALEI 1932", cemented in a drill hole in a 1-1/2-foot boulder that projects 4 inches above ground.

Reference mark number one is a standard disk stamped "ALEI NO 1", cemented in a drill hole in a 3-foot boulder that projects 2 inches above ground. It is in a bare, rocky strip, resembling a road and is 0.9 foot higher than station mark.

Reference mark number two is a standard disk marked "ALEI NO 2", cemented in a drill hole in a 3 x 4-foot boulder that projects 1.5 feet above ground. This boulder is the center of a pattern of 4 prominent rounded boulders that lay on the slope. The mark is 0.7 feet lower than station mark. NOTE: A considerable discrepancy was found in the distance to reference mark number two; the 184.9 distance is believed to be inaccurate because of the great difference in elevation between station and reference mark. The distance in this description is computed from a slope measurement and a vertical angle.

*Name of chief party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

NOTE: One of these forms must be used for every station recovered.
HORIZONTAL CONTROL DATA

JUNE 1978
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEOGRAPHIC SURVEY

HORIZONTAL CONTROL DATA

QUAD 211561
STATION 1071
HAWAII
LATITUDE 21° 30' T0 22° 00'
LONGITUDE 158° 00' TO 158° 30'
DIAGRAM NO. 4-11 OAHU

NAME OF STATION: ANTENNA
STATE: HAWAII
COUNTY: Honolulu

CHIEF OF PARTY: E.E. Jones
YEAR: 1958

NOTE: NOT ELEVATION ABOVE ELEVATION BASE
HEIGHT OF SELECTED POINT ABOVE BASE
RED-1.5
BLACK-1.5

DESCRIPTION OF TRIANGULATION STATION

RED antenna mark

DISTANCES AND DIRECTIONS TO ADJACENT MARKS, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>DISTANCE</th>
<th>MEASUREMENT</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
<td>00 00 00.0</td>
<td>17 01 16</td>
<td></td>
</tr>
</tbody>
</table>

Heights are given above the elevation base.

The station is 6.5 miles north of Waimanalo, 3.0 miles east of the Kaena Point Lighthouse and about 2.5 miles south-east of the west end of the Dillingham Air Force Base runway, it is in the center of the antenna installation on Kaena Point.

To reach the station from the post office go west and north on the main traveled road for 6.5 miles to a cemetary on the right at the end of the pavement, continue straight ahead for 1.5 miles to a T-roads right turn right and follow the winding road up the hill for 1.5 miles to the top and a T-intersection, turn right and go east for 0.4 miles to the antenna installation on the right and the station.

The standard disk stumped ANTENNA 1958, is set in the center of the second floor installation, access to the station is through a door, this station is enclosed in a cylindrical steel structure and sees no station or reference marks.

NAME OF STATION: ANTENNA

RECOVERY NOTE. TRIANGULATION STATION

R

NAME OF STATION: ANTENNA

EXAMINED BY: E.E. Jones
YEAR: 1958
STATE: HAWAII
RECOVERED BY: D.O. Rushford
YEAR: 1964
COUNTY: Honolulu

Detailed statement as to the status of the original description, including marks found, stumps, changes made, and other pertinent facts:

Station mark was recovered in good condition as described in 1958.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: ANTENNA
STATE: HAWAII
YEAR: 1958

SOURCE: G-11764

GEODETIC LATITUDE: 21° 35' 51.0898
GEODETIC LONGITUDE: 158° 14' 29.5574
ELEVATION: 414.8 METERS

STATE COORDINATES (feet):

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X (feet)</th>
<th>Y (feet)</th>
<th>Z (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>417,920.06</td>
<td>144,559.89</td>
<td>-0 05 20</td>
</tr>
</tbody>
</table>

TO STATION OR OBJECT: GEODETIC ADJACENT PLANE ADJACENT ELEV.

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>GEODETIC ADJACENT</th>
<th>PLANE ADJACENT</th>
<th>ELEV.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
<td>95 25 19.3</td>
<td>95 30 39</td>
<td>5103</td>
</tr>
</tbody>
</table>
HORIZONTAL CONTROL DATA

DEPARTMENT OF COMMERCER
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the National Ocean Survey
OLD HAWAIIAN DATUM

QUAD 211581 STATION 1072
HAWAII LATITUDE 21°30' TO 22°00'
LONGITUDE 158°00' TO 158°30'
DIAGRAM NO. 4-H C401

DEPARTMENT OF COMMERCE
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the National Ocean Survey
OLD HAWAIIAN DATUM

QUAD 211581 STATION 1072
HAWAII LATITUDE 21°30' TO 22°00'
LONGITUDE 158°00' TO 158°30'
DIAGRAM NO. 4-H C401

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: BENCH MARK 60 A USE
STATE: HAWAII
YEAR: 1958
THIRD ORDER

SOURCE: 6-11764

GEODETIC LATITUDE: 158°43'35.9838
ELEVATION: 20 METERS

STATE COORDINATES (FT):

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (Hdg or Hdg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>417,305.75</td>
<td>139,528.55</td>
<td>- 0°05'22&quot;</td>
</tr>
</tbody>
</table>

*PLAN ADEQUATE HAS BEEN COMPLETED BY THE 9-X-9 FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT: GEODETIC ADEQUATE PLAN ADEQUATE CODE

RED 145 04 32.3 145 09 54 5103

QF 401

(continued on next page)
HORIZONTAL CONTROL DATA

NAME OF STATION: CACTUS
STATE: Hawaii
COUNTY: Honolulu
CHIEF OF PARTY: E.E. Jones
YEAR: 1958
DEPHT OF TELESCOPE ABOVE STATION BASE: 1.5
HEIGHT OF LISSABY ABOVE STATION MARK: 1.8

OBJECT DISTANCES AND DIRECTIONS TO ADJACENT MARKS, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>MEANING</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
</table>
| 12a RED | 30.49    | 9.90     | 94° 44' 50"
| RM 1   |          |          |           |

The station is 7.0 miles north of Waimanu, 2.5 miles east of Kaena Point Light house and 2.5 miles south-west of the west end of the Dillingham Air Force Base runway.

To reach the station from the post office in Waimanu go north on the main traveled road F or 6.9 miles to the end of the pavement and a cemetery on the right, continue straight ahead for 1.5 miles to a T-road right, turn right and follow the winding road up the steep hill for 1.5 miles to the top and a T-intersection. Turn left and go 0.1 mile, then pack south to the top of the hill and the station, a 10 minute walk.

The station is located on a small disk named CACTUS 1958 set in a drill hole in a boulder and is near the west end of the top of the hill.

Reference mark number 1, a standard disk named CACTUS NO 1, 1958 is set in a drill hole in a boulder and is about the same elevation as the station.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: CACTUS
ESTABLISHED BY: E.E. Jones
YEAR: 1958
STATE: Hawaii
BENCHMARK ALSO:
RECOVERED BY: G. Andersen
YEAR: 1967
COUNTY: Honolulu
AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN:

Detailed statements as to the basis of the original description, including marks found, survey, changes made, and other pertinent facts:

Recovered as described and found in good condition.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: CACTUS
STATE: Hawaii
YEAR: 1958
THIRD ORDER

SOURCE: G-11764

DESCRIPTIVE LATTITUDE: 21° 34' 00" N
DESCRIPTIVE LONGITUDE: 158° 14' 53.80" W
ELEVATION: 4114 Meters
1350 Feet

STATE COORDINATES (FACW)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z(1000)</th>
<th>E(1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>415,707.75</td>
<td>145,377.72</td>
<td>-0.0526</td>
<td></td>
</tr>
</tbody>
</table>

PLANE DISTANCE HAS BEEN COMPUTED BY THE EQUATION: 4 FORMULAS, THE F FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT | GEODETIC DISTANCE | GEODETIC ANGULATIONS | PLANER DISTANCE | CODE |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
<td>76 41 07.1</td>
<td>76 46 35</td>
<td>5103</td>
<td></td>
</tr>
</tbody>
</table>

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

FORM CASS-63B 1-60
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

QF 458
Camp (Oahu Island, L. G. Simmons, 1927).—In Waialua district, on the north slope of Waianae Range, about 1.5 miles south and west of Kualhalo rail road station, on the end of a ridge west of a lone ranch house about 140 feet north of or below a fence line. Best reached by first gulch east of station. Marked according to note 5a, standard disk station mark in concrete in the Reference marks set according to note 12a, standard reference disks in concrete in tile, are at the following distances and azimuths from the station: No. 1, 18.455 meters (44.16 feet), 290° 27'; No. 2, 21.490 meters (70.51 feet), 124° 11'; Re-marked according to note 14A in 1920.

Camp—Station and R.M. 1 recovered in good condition. R.M. 2 has been destroyed. A good trail leads up the gulch 0.6 mile E of the station.

Recovery Note, Triangulation Station

Station mark and reference mark number one were recovered in good condition. Reference mark number two has been destroyed by erosion. A new reference mark, number three, was established. A complete description follows:

Station is located about 5 miles west of Waialua, on the northwest point of the end of a ridge overlooking Bingham Airfield. It is at about 1048 feet elevation and is about 100 feet west of an old cabin on point of ridge across draw.

To reach station from the post office in Waianae, go north on State Highway 90 for 0.1 miles; turn right on paved side road, and go 2.0 miles to top of hill and T-junction. Turn right and go 0.6 mile; take right fork, dirt road downhill, and go 0.6 miles to large cabin on left. Continue on road along ridge for 0.3 miles to fork. Take left fork and go 1.0 mile to side road left, on mile two right curve of main road. Go left down ridge for 1.25 miles to end of road. Continue ahead, picking up on dirt track through brush for 0.25 miles to station. (Note: A 4-wheel-drive vehicle is required.)

Station mark could not be examined because a large iron post, which is part of the HPS Type A signal, rests upon it. The 3-inch soil pipe in which the mark is set projects 1 inch above ground. The 3-1/2-foot square concrete platform of the signal is about 3 feet above ground. A red and white metal target extends 6 feet above the platform.

Reference mark number one is a standard disk stamped "CAMP NO. 1", set in cement in the top of a 3-inch soil pipe that projects 1 foot above ground. It is 10 feet east of the southeast corner of a bare, red, eroded area and is 1.7 feet lower than station mark.

Reference mark number three is a standard disk stamped "CAMP 1927 NO 1 1904", brazed to the top of a 1-1/2-inch iron pipe that is set in cement and projects 6 inches above ground. It is in a grass and brush area and is 4.8 feet higher than station mark.
**HORIZONTAL CONTROL DATA**

**QUAD 211501**  
**STATION 1078**  
**HAWAII**  
**LATTITUDE 21° 30' 00 - 22° 00' 00**  
**LONGITUDE 158° 00' 00 - 159° 30' 00**  
**DIAGRAM HP 4.11 OAHU**

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** CROSS ON ROCK WALL  
**STATE:** HAWAII  
**YEAR:** 1964  
**SECOND:** 1966  
**SOURCE:** G-12664

**RE OBSERVATION CHECK ON THIS POSITION**

<table>
<thead>
<tr>
<th>GEODETIC LATITUDE:</th>
<th>21° 55' 02.697</th>
<th>ELEVATION Meter: 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEODETIC LONGITUDE:</td>
<td>158° 10' 30.536</td>
<td>SCALED FEET</td>
</tr>
</tbody>
</table>

**STATE COORDINATES (feet):**

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (10Δ + 4)</th>
<th>1'</th>
<th>2&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>440,490.13</td>
<td>151,655.08</td>
<td>- 0° 03'.52</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*PLANE AZIMUTH HAS BEEN COMPUTED BY THE Δ (10Δ + 4) FORMULA NEGLECTING THE SECOND TERM.*

**TO STATION OR OBJECT**

<table>
<thead>
<tr>
<th>GEODETIC AZIMUTH (from north)</th>
<th>PLANE AZIMUTH (from north)</th>
<th>CODE</th>
</tr>
</thead>
</table>

**POSITION DETERMINED BY TRAVERSE FROM STATION DILLINGHAM**

QF 570
**HORIZONTAL CONTROL DATA**

**by the National Ocean Survey**
**OLD HAWAIIAN DATUM**

**DILLINGHAM (Oahu Island, L. G. Simmons, 1927).—In Waialua District, western coast of Oahu, about 1/2 mile east of Kawainapali railroad station, 3/4 mile west of Mokuleia railroad station, on edge of bank or dune in pasture of Dillingham ranch, on shore line, about 100 yards west of small boathouse and 200 yards east of fence line marking western limits of pasture. Marked according to note in standard disk in concrete block. Reference marks, note 11a, standard reference disks in concrete blocks, were set at the following distances and azimuths from station: No. 1, 31.076 meters (101.93 feet), 52° 58' 36". No. 2, 45.000 meters, (147.49 feet), 318° 09' 03". Re-marked according to note 11A in 1928.**

**DILLINGHAM (Hawaii, L.G.S., 1927; H.A.P., 1938).—Recovered in good condition. The boathouse E of station has been removed. Remains of an old pier were found. Stone high-water line is 5-1/2 meters R of station.**

(477th Pol. Bur., 1948) Station is about 1-1/2 miles E of Kawainapali railroad station, 1/2 mile W of Mokuleia railroad station, on edge of bank or dune in pasture of Dillingham ranch, on shoreline, about 100 yards W of small boathouse, and 200 yards E of fence line marking W limits of pasture.

Station is marked with a standard station disk set in the top of a square block of concrete. This station is now marked as above with a concrete platform about 6 feet above the ground above a pipe 10 feet high with a target point 2-1/2-inch pipe with a signal pole 10 feet high. Station is marked with a standard station disk set in the top of a square block of concrete. The target is painted red and white.**

**OBJECT**

<table>
<thead>
<tr>
<th>DISTANCE</th>
<th>AZIMUTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meters</td>
<td></td>
</tr>
<tr>
<td>R.M. 1</td>
<td>31.076</td>
</tr>
</tbody>
</table>
| R.M. 2   | 45.000   | 318°09'03"

**STATE & ZONE**

<table>
<thead>
<tr>
<th>CODE</th>
<th>N</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI</td>
<td>3</td>
<td>440,486.92</td>
</tr>
</tbody>
</table>

Station coordinates are:

**STATE & ZONE**

<table>
<thead>
<tr>
<th>CODE</th>
<th>N</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI</td>
<td>3</td>
<td>440,486.92</td>
</tr>
</tbody>
</table>

**PLANE AZIMUTH**

plane azimuth (from station) plane azimuth (from object) code

NOKU 29°30'37.1" 29°34'29" 5103

**DIAGRAM**

**E.R. Waiting Station**

(continued on next page)
The station subsurface mark was recovered. The surface mark was destroyed by a tidal wave which has lowered the beach in the vicinity about 3 feet. At the same time the Hawaiian Territorial Survey Type A signal was shifted seaward and nearly buried about 8 feet north of station. The concrete monument in which R.M. No. 1 was set was found with the top broken off and the mark gone. R.M. No. 2 was not found and is believed destroyed. The underground mark was lowered and a new surface mark set over it.

Two new reference marks were established. A complete description follows:

Station is located along the north shore of Oahu, about 3 miles west of Waialua, 1/2 mile west-northwest of the mouth of Makaha Stream, 100 yards east-southeast of northernmost tip of point and just outside the north fence of a large pasture owned by the Crowbar Ranch.

To reach station from the highway overpass at south end of Waialua, go west on State Highway 99 for 3.4 miles to red board gate on right (may be obtained at the ranch office on left side of highway). Pass through gate and go north across pasture for 0.8 mile to fence and station just outside fence, in sand beach area.

Station mark is a standard disk stamped "DILLINGHAM 1927 1964", set in the top of a 2-foot-diameter mass of concrete and rock flush with sand. It is 15 yards west of a row of old pipes in the water, 5.6 feet north of fence, and 3 feet lower than bottom wire of fence.

Reference mark number three is a standard disk stamped "DILLINGHAM No 3 1937 1964", set in the top of a 12-inch-square, concrete monument that projects 8 inches. It is on the bank, 2.8 feet north of fence, 7.5 feet south-west of a tree stump on ironwood tree, and 2.9 feet higher than station.

Reference mark number four is a standard disk stamped "DILLINGHAM No 4 1937 1964", cemented in a drill hole in the top of a 12-inch-square, concrete monument that projects 3 inches (this is old R.M. No. 1 monument). It is on west edge of 30-inch ditch, 22 feet west of a large ironwood tree that has been burned.

Cross on rock wall is a 2-inch, chiseled cross in rock at center of the exposed part of the old HTS Type A signal, which is 7 feet long, 4 feet thick, constructed of stone and concrete, and projects 1-1/2 feet from the sand on a 45-degree tilt.

---

NOTE: The officer who actually visited the station should sign his name at the end of the recovery notes.

NOTE: One of these forms must be used for every station recovered.
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

NO ORIGINAL TEXT

Ena (Puena) (Oahu Island, O. B. French, 1910; L. G. Simmons, 1927)—The station Puena of 1878 was not recovered in 1910, but a new station, called Ena, was established in approximately the same location. Between 1914 and 1920 the United States Engineers had a station in the same position as the 1910 station, but no description of their station is available, other than the report in 1927 that the Army mark was recovered and used. The 1927 description tallies so closely with 1910 description, and the positions determined in 1910, 1914–1920, and 1927 are so closely in agreement that it seems reasonably certain that the same station was used in each of these years, and for it the position determined in 1910, being the strongest, is given. The station is on the northwest coast of Oahu, about 0.6 mile north of Haliwa Hotel, on north side of Waihau Bay, about halfway out on Puena Point, and on south side of point. Marked by a 1-inch pipe cemented in a block of concrete 3 feet square. Reference marks were standard reference disks in outcropping bedrock, note 12a, set at the following distances and azimuths from the station: No. 1, 32.78 meters (107.6 feet), 91° 21'; No. 2, 42.53 meters (139.3 feet), 130° 26'. Re-marked according to note 14A in 1920.

(477th PA Obsn.0n, 1945)—About 0.6 mile N of Haleiwa Hotel on the S side of Puena Point. The Note 14A marking placed in 1929 has been destroyed by airstrip construction. Reference marks were recovered in good condition; these being in coral outcrop and clear of construction area.

RECOVERY NOTE, TRIANGULATION STATION R

NAME OF STATION: ENA (PUENA)
Established: 0.R.P. YEAR: 1910 STATE: Hawaii
Recovered by: W.K. Porter YEAR: 1953 COUNTY: Honolulu

Detailed statement as to the status of the original description, including marks found, stenciling, changes made, and other pertinent facts:
The station mark has been destroyed. Both reference marks were recovered in good condition, and the exact station point determined by measuring from them, in addition to measuring check angles. An excavation 8 feet deep was made but nothing found. Pieces of the old signal built over the mark were found scattered in the vicinity.
Reference mark number one is a standard disk stamped "PUENA NO. 1 1927", cemented in a drill hole in coral bedrock, 60 feet southeast of the shoreline and 27 feet northwest of edge of sand.
Reference mark number two is a standard disk stamped "PUENA NO. 2 1927", cemented in a drill hole in coral bedrock, 60 feet southeast of the shoreline and 45 feet northwest of a sandbank.
Located on Puena Point, about 1 mile north of Haleiwa and 175 yards west from southwest end of old airstrip.

*Plane azimuth has been computed by the 8-MG-11 formula neglecting the second term.

OS survey of this mark must be made for every station reviewed.

U.S. DEPARTMENT OF COMMERCE • COAST AND GEODETIC SURVEY

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: ENA-PUENA
STATE: HAWAI'I
YEAR: 1910
THIRD ORDER

SOURCE 5-SP156

LATITUDE: 21° 36' 22.577'
LONGITUDE: 156° 06' 22.648'

STATE COORDINATES (feet):

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI-3</td>
<td>5103</td>
<td>482,947.91</td>
<td>159,694.69</td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the 8-MG-11 formula neglecting the second term.

U.S. DEPARTMENT OF COMMERCE • COAST AND GEODETIC SURVEY

GI 357
## HORIZONTAL CONTROL DATA

### DESCRIPTION OF TRIANGULATION STATION

**Name of Station:** FENCE  
**State:** Hawaii  
**County:** Honolulu

**Chief of Party:** E.E. Jones  
**Year:** 1958  
**Described by:** L.W.

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>BEARING</th>
<th>DISTANCE (feet)</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CACTUS</td>
<td>W</td>
<td>00</td>
<td>00.0</td>
</tr>
<tr>
<td>Towell Station No.13</td>
<td></td>
<td>357</td>
<td>48.0</td>
</tr>
</tbody>
</table>

The station is 6.5 miles north of Waianae, 3.0 miles east of Kaena Point Light House, and 2.8 miles south-west of the west end of the Billingham Air Force Base runway.

To reach the station from the post office in Waianae go west and north on the main traveled road for 6.9 miles to a cemetery on the right at the end of the pavement, continue straight ahead for 1.5 miles to a T-intersection turn right and follow the winding road 1.6 miles to the top of the hill and a T-intersection, turn right and go 0.4 miles to the antenna installation on the right. The station is about 100 feet east of the radar antenna and about 8.0 feet west of a high mesh wire fence.

The station a standard disk stamped "FENCE 1958" is set in a drill hole in a piece of buried concrete and is flush with the ground. Towell Station No.13 is an unstamped 1.0 inch iron pipe projecting 6 inches, it is 182 feet west of the station and almost on line with station CACTUS.

### ADJUSTED HORIZONTAL CONTROL DATA

**Name of Station:** FENCE  
**State:** Hawaii  
**Year:** 1958

**Geodetic Latitude:** 21°33'49.7"N  
**Geodetic Longitude:** 158°14'28.5"W  
**Elevation:** 408.3 feet

**State Coordinates (foot):**

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>418,014.12</td>
<td>144,325.86</td>
<td>-0 05 19</td>
</tr>
</tbody>
</table>

**Notes:**

- The station was recovered and found in good condition, however Towell Station #13 was not found; there are some mobile offices setting in this area and is believed destroyed.
- The station is located on the ridge above Kaena Point, at the Keana Point Tracking Station, in the east end of the antenna building compound, in a fence corner, about 1800 feet southeast from the T-Junction at the Security Guard shack.
- The station is a standard disk stamped "FENCE 1958", cemented in a drill hole in a piece of buried concrete that is about 6 inches in diameter on the top. It is 8 feet west of the north-south fence, 8.7 feet west-northwest of the fence corner post, 2.8 feet west-northwest of the northwest corner of a small, red, paint-storage shack and is about 4 inches below ground surface.
- No reference marks established.

---

**Diagram 6-1764**

### RECOVERY NOTE, TRIANGULATION STATION

**Name of Station:** FENCE  
**Year:** 1956  
**State:** Hawaii  
**County:** Honolulu

**Recovered by:** E.E. Jones  
**Recovery Date:** 1956  
**County:** Honolulu

**Detailed statement as to the fitness of the original description, including marks found, stanchings, changes made, and other pertinent facts:**

Station mark was recovered and found in good condition, however Towell Station #13 was not found; there are some mobile offices setting in this area and is believed destroyed.

Station is located on the ridge above Kaena Point, at the Keana Point Tracking Station, in the east end of the antenna building compound, in a fence corner, about 1800 feet southeast from the T-Junction at the Security Guard shack.

Station mark is a standard disk stamped "FENCE 1958", cemented in a drill hole in a piece of buried concrete that is about 6 inches in diameter on the top. It is 8 feet west of the north-south fence, 8.7 feet west-northwest of the fence corner post, 2.8 feet west-northwest of the northwest corner of a small, red, paint-storage shack and is about 4 inches below ground surface.

No reference marks established.

---

*Note: Chief of Party should be journaled here. The officer in charge invested the station should sign his name at the end of the recovery note.

**R-1234**
HAILI (Hawaii, H.A.P., 1932)--Station is 4-1/2 miles E of Kaena Point, on a broad ridge E of Haili Gulch. A prominent shoulder (elevation 800 feet) projects out from general line of the cliff on the W side of this gulch. Station MAHOE is visible. Station and L.M.s 1 and 2 are standard disks set in concrete in depressions in boulders.

To reach station, follow the trail past station CAMP and around gulches.

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAHOE</td>
<td>7.20</td>
<td>0 00 05'</td>
</tr>
<tr>
<td>R.M. 1</td>
<td>7.45</td>
<td>184 01 00'</td>
</tr>
<tr>
<td>R.M. 2</td>
<td>7.70</td>
<td>254 15 40'</td>
</tr>
</tbody>
</table>

Height of signal above station mark = 3 meters.
Height of instrument above station mark = 1.6 meters.

HAILI (Hawaii, H.A.P., 1932; O.A.M., 1951) --Station destroyed. Reference mark 2 disturbed. Reference mark 1 appears O.K. but is on a small rock which is easily movable as was reference mark 1.

RECOVERY NOTE, TRIANGULATION STATION

<table>
<thead>
<tr>
<th>STATE</th>
<th>HAILI</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR</td>
<td>1932</td>
</tr>
<tr>
<td>STATE</td>
<td>HAWAII</td>
</tr>
<tr>
<td>YEAR</td>
<td>1932</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STATE COORDINATES (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE &amp; ZONE</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>HI 3</td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the following formula neglecting the second term.

<table>
<thead>
<tr>
<th>TO STATION or O BECT</th>
<th>GEODETIC AZIMUTH (from north)</th>
<th>PLANE AZIMUTH (from north)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAHOE</td>
<td>158°54'45.4&quot;</td>
<td>158°59'27&quot;</td>
<td>5103</td>
</tr>
</tbody>
</table>
HORIZONTAL CONTROL DATA

by the National Ocean Survey
OLD HAWAIIAN DATUM

HIKE (Hawaii, N.A.P., 1932)--Station is 3 miles E of Keena Point and 0.6 mile W of the U.N.O.A. camp on the N side of the railroad, where it passes through a small outcrop of rock. Station and R.M. 1 and 2 are standard disk sets in concrete in depressions in boulders.

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARKER</td>
<td>100 yards</td>
<td>0°00'00&quot;</td>
</tr>
<tr>
<td>Telephone pole 1090</td>
<td>18.64</td>
<td>48 48</td>
</tr>
<tr>
<td>R.M. 1</td>
<td>15.67</td>
<td>222 07 50</td>
</tr>
<tr>
<td>R.M. 2</td>
<td>18.78</td>
<td>97 0</td>
</tr>
<tr>
<td>High-water line</td>
<td>238</td>
<td>330</td>
</tr>
<tr>
<td>R.M. 1</td>
<td>Height of signal above station mark - 0.3 meters.</td>
<td></td>
</tr>
<tr>
<td>R.M. 1</td>
<td>Height of instrument above station mark - 1.5 meters.</td>
<td></td>
</tr>
</tbody>
</table>

Station is 3 miles E of Keena Point. Railroad passes through a small outcrop at this point.

RECOVERY NOTE. TRIANGULATION STATION

NAME OF MARKER: HIKE
ESTABLISHED BY: H.A.P.
RECOVERY BY: W.P. Porter
YEAR: 1932
STATE: Hawaii
CITY: Honolulu

Detailed statement as to the contents of the original description; including marks found, stamplings, changes made, and any pertinent facts:

Station mark was recovered and found to be in good condition, however, a new station, HIKE 2, was established nearby, but since the railroad was used extensively, it was not removed upon completion of the building of the new station. Since the station will be lost no new reference marks were established. A complete description follows:

Station is located along the north coast of Oahu, about 3 miles airline east of Keena Point and 1/4 mile west of Camp Erdman, on the east end of a dirt bank along the north side of an old railroad bed, where it passes through a large outcrop.

To reach station from the post office in Wahiawa, go south on Goodale Avenue for 0.2 mile; take right fork and go west on State Highway 99 for 6.2 miles to end of paved road; continue ahead on graded road along coastline for 0.5 mile to Camp Erdman gate on the right; continue ahead for 0.8 mile to road junction between power poles No. 244 and 246, and the station on right.

Station mark is a standard disk stamped "HIKE 1932", cemented in a drill hole in the top of a 2-foot boulder flush with the ground, but with its entire north side exposed due to water run-off. It is 30 feet north of center line of old railroad bed, 75 feet north of the edge of the north and lower one of two parallel roads (and about 20 feet lower than this road), 50 feet northeast of the stub of a 0 x 8-foot post, 250 feet northeast of power pole No. 244, 29 meters from station HIKE 2 in azimuth 118° 06' 05", and about 15 feet higher than the rock beach.

NOTE: See description for HIKE 2.

(continued on next page)
RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: HIKE
ESTABLISHED BY: H.A.P.
RECOVERED BY: D.M. Whipp
YEAR: 1939
STATE: Hawaii
COUNTY: Honolulu
DISCR. DISTANCE AND DIRECTION FROM NEAREST TOWN:

Detailed account as to the features of the original description, including marks found, surroundings, changes made, and other pertinent facts:

Station was found destroyed by erosion; the boulder had become dislodged and rolled down to the beach. The disk was removed and taken to the Coast and Geodetic Survey Office in Honolulu.

NOTE: This station was found to be in danger of loss due to erosion in 1965 so a new station, HIKE 2, was established nearby at that time. See description for HIKE 2.
**HORIZONTAL CONTROL DATA**

**DEPARTMENT OF COMMERCE**
**NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION**
**NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY**

**DESCRIPTION OF TRIANGULATION STATION**

**NAME OF STATION:** HILL  
**STATE:** Hawaii  
**COUNTY:** Honolulu  
**YEAR:** 1958  
**DESCRIPTED BY:** L.N.  

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>DEPARTING</th>
<th>DISTANCE (RTN)</th>
<th>DIRECTION (RTH)</th>
<th>OBJECT</th>
<th>MEETING</th>
<th>DISTANCE (RTN)</th>
<th>DIRECTION (RTH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CACTUS</td>
<td>NE</td>
<td>35.76</td>
<td>10.901</td>
<td>BM 1</td>
<td>NE</td>
<td>0.00</td>
<td>0.00 0.00</td>
</tr>
</tbody>
</table>

The station is on the highest part of a prominent hill 3.0 miles east of the Kaneohe Point Light House, 3.8 miles south-east of the west end of Dillingham Air Force Base runway, about 7.0 miles north of Waianae, on Oahu Island, T.H.

To reach the station from the post office in Waianae go west and north on the main road for 6.9 miles to the end of the pavement at a cemetery on the right, continue a bit ahead for 1.5 miles to a T-intersection on the right, turn right and follow the winding road up the steep hill for 1.6 miles to the top and a T-intersection. Turn right and follow the main road west to its end. From the west end of the hill to its highest point and the station, a 10 minute pace.

The station a standard disk stamped HILL 1958 NO 1, is set in a drill hole on a bedrock on the highest part of the hill. Reference mark no. 1 standard disk stamped HILL 1958 NO 1, is set in a drill hole in a boulder and is about the same elevation as the station.

---

**RECOVERY NOTE, TRIANGULATION STATION**

**NAME OF STATION:** HILL  
**EXCAVATED BY:** R.E.P.  
**YEAR:** 1958  
**STATE:** Hawaii  
**RECOVERED BY:** W.R.P.  
**YEAR:** 1960  
**COUNTY:** Honolulu

Detailed statements as to the sizes of the original description, including marks found, stampings, changes made, and other pertinent facts.

This station was destroyed by construction.

---

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** HILL  
**STATE:** Hawaii  
**YEAR:** 1958  

- **SOURCE:** G-11764

**STATE COORDINATES (FOE)**

<table>
<thead>
<tr>
<th>STATE &amp; CODE</th>
<th>COORD X</th>
<th>COORD Y</th>
<th>Z</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI : 3</td>
<td>5103</td>
<td>417,560,38</td>
<td>145,799,65</td>
<td>0.05 21</td>
</tr>
</tbody>
</table>

- **PLAN APEX MEASURED IN THE FIELD AT THE STATION**

<table>
<thead>
<tr>
<th>STATION OBJECT</th>
<th>GEODETIC AZIMUTH</th>
<th>GEODETIC LONGITUDE</th>
<th>PLANE AZIMUTH</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CACTUS</td>
<td>77 04 50.4</td>
<td>77 10 12</td>
<td>5103</td>
<td>QF 459</td>
</tr>
</tbody>
</table>
HORIZONTAL CONTROL DATA

NAME OF STATION: KAREA ASTRO
STATE: Hawaii
COUNTY: Honolulu

CHIEF OF PARTY: O. A. Anderson
YEAR: 1967
DESCRIBED BY: O. A. Anderson

HEIGHT OF TELESCOPE ABOVE STATION MARK (METERS): 2.0
HEIGHT OF LIGHT ABOVE STATION MARK (METERS): 4.0
DISTANCES AND DIRECTIONS TO ADJOINING STATIONS (FEET AND METERS):

OBJECT | MEASURING | DISTANCE | DIRECTION
-------|-----------|----------|----------

Station is located on the northwest corner of Oahu Island, at the Kaena Point Tracking Station, located about 1000 feet east of the Headquarters Building, on the highest part of a hill and about 150 feet east of a silver water tank.

To reach the site from the guard building at the gate, turn right, east, at the guard building and proceed 0.3 mile to a road left where the main road passes thru a gate into a fenced area, turn left northeast, and proceed 0.3 mile to a T-road right, turn right uphill for 0.15 mile passing thru a gate enroute to a silver water tank near the top of the hill, and of vehicle travel at the water tank, park east via gate to the highest point of the hill and mark, approximately a 200 ft. peak.

The mark is set in the center of the top of an abandoned concrete antenna pier which is 12 feet square and projects 3.5 feet. The mark is a standard disk stamped "KAREA ASTRO 1967".

No reference marks or azimuth mark were set.

*Relates to error in angular and line reductions of triangulations. 10Direction-reduction azimuths, reduced to initial station.
*2Angles greater than 180°, when no independent leveling is being done.

STATE COORDINATES (FINS):

<table>
<thead>
<tr>
<th>STATE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI</td>
<td>3</td>
<td>418,911.85</td>
<td>144,089.71</td>
<td>-0°05'16&quot;</td>
</tr>
</tbody>
</table>

SQUARE OF 450
KAENA #5 (Hawaii, N.A.P., 1932)—About 0.6 mile E of Kaena Point, on the ridge leading down from Pau Fuego, at an elevation of about 800 feet, a square concrete observation post built by the U.S. Army. The station is the center of the 3-inch pipe projecting about 1-1/3 feet through the roof.

A good trail leads up to the station from the N side of the point about 0.4 mile E of the light.

OBJECT | DISTANCE | DIRECTION
------- | -------- | --------
KAENA PT. LT. | 46 11 50 | 0 00 00 00
R.M. 1 | 10.05 | 326 18 30
R.M. 2 | 1.42 | 0 00 00 30

Height of signal above station mark = 3 meters. Height of instrument above station mark = 1.6 meters.

(177th Fa Oahu, No., 1948)—About 600 yards E of Kaena Point on the ridge leading down from Pau Fuego, at an elevation of 584 feet. The station is the center of the 3-inch pipe projecting about 1-1/3 feet through roof of old observation post. A new observation post has been constructed immediately in front of old Kaena #5.

To reach station, drive to gate which is located about 400 yards off the main road and 600 yards E of Kaena Point Lighthouse. Then proceed up stairs to trail and continue up trail to junction with trail off to left and station site. A gate will be seen just off main trail before the station site.

Station is in good condition, though abandoned. Reference marks are U.S. Military Reservation Markers set in concrete posts. They are as described and in good condition.

(continued on next page)
HORIZONTAL CONTROL DATA

by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

KAENA 3 (continued)

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KAENA 3
ESTABLISHED BY: NA-P1
RECOVERED BY: D.J. Rushford
YEAR: 1932
STATE: Hawaii
COUNTY: Honolulu

HEIGHT OF TELESCOPE ABOVE STATION MARK: 1.42 METER
HEIGHT OF LIGHT ABOVE STATION MARK: METER

DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROGNOMIC OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION:

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>MEASUREMENT</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>KAENA POINT LIGHT 1927 R.M. No. 2</td>
<td>SW</td>
<td>32.940</td>
<td>10.040</td>
</tr>
</tbody>
</table>

Station mark and reference mark number two were recovered in good condition. Reference mark number one was searched for by distance and angle but was not found and is believed destroyed by erosion. A complete description follows:

Station is located at Kaena Point (the westernmost point of Oahu), 1/2-mile east of Kaena Point Light, at about 80 feet elevation, on the roof of an old military observation post.

To reach station from the highway overpass at Waialua, go west on State Highway 99 for 7.0 miles to Camp Broman on the right. Continue on the highway for 3.4 miles to a fork at power pole No. 206, 0.1 mile before reaching the right fork to Kaena Point Light. Take left fork and go up around end of ridge for 0.15 mile to end of truck travel by concrete camouflaged bank on left. Climb up this bank and follow trail up ridge to station. About a 20-minute pack.

Station is the center of a 2-inch-diameter iron cap on the top of an iron pipe that projects 2 feet from the concrete roof of the old observation post. A rock covering on the roof comes up to within 3 inches of the top of the pipe. Station is 5.5 feet east from west end of roof and 6.2 feet west-northwest of the northwest corner of the roof entrance of the observation post. A later observation post was constructed at the west end of the old one that the station is on. This later one is 4 feet lower and the two are separated by 4 feet.

Reference mark number two is a U.S. Military Reservation Boundary Mark, with a large cross in the center and stamped "4", set in the top of a 7-inch-square, concrete post flush with the ground. It is at the west edge of the old trail, above a stone bulkhead supporting the trail and is 16.2 feet lower than station mark.

NOTE - One of these forms must be used for every station recovered.

USGS-DC 8717-P90
NO ORIGINAL TEXT

KAHANAIKI (U.S.E.) (Kahala, U.S.E., 1914; O.A.N., 1952)

brass plate set in a 5-in. concrete pipe.

NO ORIGINAL TEXT

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the National Ocean Survey
OLD HAWAIIAN DATUM

QUAD 211591 STATION 1087
HAWAII
LATITUDE 21° 30' TO 22° 00'
LONGITUDE 158° 00' TO 158° 30'
DIAGRAM NF 411 OAHU

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KAHANAIKI USE
STATE: HAWAII
YEAR: 1914
ORDER: THIRD

SOURCE: G-SP150

DESCRIPTIVE LATITUDE: 21° 32' 46.033
DESCRIPTIVE LONGITUDE: 158° 11' 49.065

ELEVATION IN FT: 107

STATE COORDINATES (Hawaii):

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (h, v, theta, angle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>433,061.39</td>
<td>136,079.01</td>
<td>0 04 20</td>
</tr>
</tbody>
</table>

* Plane azimuth has been computed by the S-20D with formula neglecting the second term

S TATION OR OBJECT | NO. | GEOGRAPHIC AZIMUTH | PLANE AZIMUTH |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Notes: Critical details shall be furnished. The owner who actually located the station should note the area of the station area.

Extensions of these notes shall be given to the extent necessary. Concr.-Dec. 1954

QI 304
KAUNAO (Hawaii, U.S.P., 1932)—Station is 3 miles N of Kaena Point, midway between Kaunao and Alei Falls, at edge of bluff.
Station can best be reached by a trail starting from a red house 1/2 mile W of Y.M.C.A. Camp, following a small water line, and up the first draw W of the station.
Station and R.M. 1 and 2 are standard disks set in concrete depressions in boulders.

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alei</td>
<td>0.0010</td>
<td>R.M. 1</td>
</tr>
<tr>
<td>R.M. 1</td>
<td>4.95</td>
<td>0.0060</td>
</tr>
<tr>
<td>R.M. 2</td>
<td>11.84</td>
<td>3.0070</td>
</tr>
</tbody>
</table>

Height of signal above station mark - 3 meters.
Height of instrument above station mark - 1.5 meters.

DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

RECOVERY NOTE. TRIANGULATION STATION

STATE: HAWAII
YEAR: 1932
THIRD ORDER

SOURCE: G-9889

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>x</th>
<th>y</th>
<th>z (CM^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>419.590.48</td>
<td>145.060.75</td>
<td>0.05 13</td>
</tr>
</tbody>
</table>

*Planes azimuth has been computed by the ZINOD formula neglecting the second term.

TO STATION OR OBJECT | GEOGRAPHIC AZIMUTH (From North) | PLANES AZIMUTH (From North) | CODE |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alei</td>
<td>83°38'45.9&quot;</td>
<td>83°44'07&quot;</td>
<td>5103</td>
</tr>
</tbody>
</table>
KAHAO (continued)

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KAHAO
ESTABLISHED BY: N.A.P.
YEAR: 1932
STATE: Hawaii
RECOVERED BY: D.S. Rankford
YEAR: 1964
COUNTY: Honolulu

HEIGHT OF TELESCOPE ABOVE STATION MARK: 1.45 METERS
HEIGHT OF LIGHT ABOVE STATION MARK: 0.0 METERS

DISTANCES AND DIRECTIONS TO AZIMUTH MARKS, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>SEASONS</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>L.G.O. 1932</td>
<td>3</td>
<td>180.676 (49.74)</td>
<td>30 49 08</td>
</tr>
<tr>
<td>R.M. No. 1</td>
<td>NW</td>
<td>43.817 (14.23)</td>
<td>294 16 18</td>
</tr>
</tbody>
</table>

Station was recovered and all marks were found in good condition.

A complete description follows:

Station is located about 3 miles east of Kaena Point and 1/4 mile southwest of Camp Erdman at edge of bluff above Kahao Falls.

To reach station from the post office in Wainapan, go north on State Highway 90 for 0.1 mile to paved side road right. Turn right and go 2.5 miles to top of hill and T-junction at guard shack. Turn right and go 0.6 mile; take right fork and follow track road down-grade, crossing canyon and going up other side, for 0.5 mile to top of ridge. Turn sharp left and go down along ridge for 0.5 mile to fork. Take right fork over top of ridge for 0.5 mile; take right fork and go down spur ridge for 0.2 mile to end of road. Pack northeast, down across draw and up onto the next ridge, then northerly down along it about 1/4 mile to station. (About a 20-minute pack).

Station mark is a standard disk stamped "KAHAO 1932", cemented in a drill hole in a 3 x 3-foot boulder that projects 6 inches above ground. It is in an area covered with lantana and tall grass, at extreme north end of hill, about 15 yards up above the rock line.

Reference mark number one is a standard disk stamped "KAHAO NO 1", cemented in a drill hole in a 2-1/2-foot boulder that projects 6 inches above ground. It is 10 feet south from edge of bluff and 2.1 feet higher than station mark.

Reference mark number two is a standard disk stamped "KAHAO NO 2", cemented in a drill hole in the 8-inch exposed section of a boulder that projects 6 inches above ground on the west side. It is at the north end of the bare red-dirt area on the north slope of the higher knoll to south of station. 16 feet northeast of a small, lone ironwood tree and 20.5 feet higher than station mark.

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

NOTE - One of these forms must be used for every station recovered.
Kaupakuhale (Oahu Island, L.G. Simmons, 1927).—In western part of Oahu, on the summit of a prominent hill on the Waialua slope of the Wai'anae Range, of same name as station, about 3/4 mile south and a little east of Molokai rail-road station. Station marked according to note 6a, a standard disk in concrete. Reference marks were set according to note 13a, standard reference disk in concrete in tiles, at the following distances and azimuths from the station: No. 1, 4,845 meters (15,909 feet), N 81° 0'; No. 2, 4,966 meters (16,399 feet), 129° 17'. Re-marked according to note 14a in 1929.

(R.M. Towill Corp., 1968).—Station recovered as described. Target repainted and some brush removed. Several large trees remain which should be removed.

Station was recovered and all marks found in good condition. A complete description follows:

Station is located about 2-1/2 miles south-west of Waialua on a brushy hill of about 1567 feet elevation that sets apart from the sloping foothills on the north side of the Wai'anae Range.

To reach station from the overpass in Waialua, go west on State Highway 99 for 1/2 miles to side road at sign "Mt. Kaala". Turn left and follow hard surfaced road for 1.3 miles to side road left at sign "Mt. Kaala". Turn left and follow dirt road for 0.6 miles to look out. Pass through gate and continue on track road winding around end of ridge and then upgrade for 1.6 miles to end of road at a bare, red, eroded end of steep hill. From here pack south-west on trail up hill to top and station. A 50-minute pack.

Station mark is a standard disk set in concrete in the top of a 5-inch soil-slope that projects 2 inches above ground. The footing could not be checked because of a large iron yoke, which is a part of the MTG Type A signal, resting within 1/4 inch of the disk. Station is on the northwest lower end of the hilltop. A Type A signal, built in 1929 by the Hawaii Territorial Survey, is set over the station mark. The 5-1/2-inch-foot-square, concrete platform is about 3 feet above ground and the red and white metal target extends about 6 feet above it.

Reference mark number one is a standard disk stamped "KAUPAKUHALE NO 1", cemented in a drill hole in the 1-inch, triangular-shaped, exposed surface of a large boulder. The mark is about 6 inches above ground surface, 1 foot higher than the station mark and located in dense brush.

Reference mark number two is a standard disk stamped "KAUPAKUHALE NO 2", set in concrete in the top of a 5-inch soil-slope that projects 2 inches above ground. It is located in dense brush and is about 2 feet lower than station mark.

Note: Key for locked gate may be obtained by calling Mr. Silva, phone 635630.

(D.M. Whipp, 1965).—Station was recovered as described in 1964 and all marks found in good condition.

Name of station: KAUPAKUHALE

State: HAWAII

Year: 1927

Second order

Source: GSP156

Geodetic latitude: 21° 32' 33.0066"

Geodetic longitude: 158° 09' 36.3633"

Elevation: 478 METERS

Scaled: 478 METERS

STATE CoORDINATES (feet)

H1 B 5103 448,419.75 136,623.31 - 0 05 21

Plane azimuth has been computed by the COORD FORMULA NEGLECTING THE SECOND TERM.

To station or object

Geodetic azimuth

Plane azimuth

Code

PUU IKI 272° 13' 46.00 272° 17' 07" 5103

Note: One of these forms must be used for every station recovered.

Name of each party should be learned here. The officers who actually visited the station should sign his name at the end of the recovery notes.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEOGRAPHIC SURVEY

HORIZONTAL CONTROL DATA

BUAD 211581

STATION 1069

Hawaii

Latitude: 21° 32' 33.0066"

Longitude: 158° 09' 36.3633"

DYNAGRAPH N 611

OAHU
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
NATIONAL OCEAN SURVEY, NATIONAL GEODENTIC SURVEY

KEALIA (Oahu Island, L. G. Simmons, 1927).—Near the western point of Oahu, on the divide of the Waianae Range, about 8 miles from Kaneo Point, on the summit of a prominent knob on top of a range near center of the Kealia district intersected by the Waianae Range. Station is best reached from the Waianae side of range. Marked according to note 6A, a standard disk station mark in concrete in the. Reference marks, note 13A, standard reference disks in concrete in tiles are at the following distances and azimuths from station: No. 1, 68.48 meters (219.59 feet), 41° 21′ 41″; No. 2, 10.08 meters (32.92 feet), 22° 29′. Re-marked according to note 14X in 1920.

KEALIA (Hawaii, L.G.S., 1927; 47th FA Obsn. B., 1345)

on the divide of the Waianae Range, about 5 miles from Keana Point, on the summit of a prominent knob on top of range near center of Kealia District intersected by the Waianae Range. Station is best reached from Waianae. Follow Highway 31 W 2-3/4 miles from highway underpass of railroad just S of Andrew Cox School, turn left through Dillingham Ranch following mountain trail 8 miles to station. Station is about 100 feet N of trail on top of knob.

Station mark, marked according to Note 14X, stands about 1 foot above surface. Concrete seat for pole has broken away on NW side.

R.M. 1, distant 191.89 feet, is on crown of ridge SW of R.M. 2, on bare ground 15 yards NNE of trail. It is a standard reference-mark disk set in concrete at the center of the top of a tile which is embedded in the ground.

R.M. 2, distant 62.42 feet, is on ridge W of station and about 7 feet above. It is a standard reference-mark disk set in concrete at the center of the top of a tile which is embedded in the ground.

RECOVERY NOTE, TRIANGULATION STATION

R

Source: G-SP15b

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>H</th>
<th>E</th>
<th>Z</th>
<th>H/FEET</th>
<th>E/FEET</th>
<th>Z/FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 2</td>
<td>5103</td>
<td>427.429.11</td>
<td>140.820.20</td>
<td>-</td>
<td>0</td>
<td>0.4</td>
<td>0.2</td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the type (R.O.M.G.) formula neglecting the second term.

To station or object, GEOGRAPHIC DIRECTION, (from north), PLANE DIRECTION, (from north), CODE

QI 295
trees for about 80 yards to station.

The concrete block mounted over station mark is 12 inches square and projects 12 inches above ground. There is a metal plate in top of block, with a depression in it to center a gaged target. Station mark was originally described as a standard disk.

Reference mark number one is a standard disk stamped "KEALIA NO 1", set in cement in the top of a 5-inch soil pipe that projects 1 foot above ground. It is on ridge line, in timber, 20 feet northeast of the trail, 5 feet northeast of a triangle blaze on a tree, and 20 yards north of road.

Reference mark number two is a standard disk stamped "KEALIA NO 2", set in cement in the top of a 5-inch soil pipe that projects 8 inches above ground. It is along the southeast side of trail to station.
**NO ORIGINAL TEXT**

**KEALIA (U.S.E.)**

- **State:** Hawaii, U.S.E., 1914; N.A.P., 1932
- **Station:** Claimed 1/4 mile S of Kaena Point, about 100 meters N of the O.R.& P. tracks, opposite telephone pole 1126, and about 400 meters W of the site of the old Kaena Point station.

Station is marked by a 5-inch pipe, filled with concrete, projecting 10 inches and surrounded by a rude mass of concrete. It has a brass plate and a 1/4 inch nipple in the top, inscribed "U.S. Engr. - Elev.", Two reference marks were built. They are brass disks set in concrete.

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R.M. 1</td>
<td>19.19</td>
<td>207 35 20</td>
</tr>
<tr>
<td>R.M. 2</td>
<td>18.47</td>
<td>226 58 10</td>
</tr>
<tr>
<td>Storm high-water line</td>
<td>21</td>
<td>276</td>
</tr>
</tbody>
</table>

(47th Alaska, 1946) - Station is situated 150 feet N of Highway 11 and railroad. It is 1500 yards from E end of air strip, N of midpoint of air strip which lies S of highway and railroad.

Station mark is a standard U.S.E. marker on a 6-inch drain pipe marked by a red flag.

R.M. 1 is 48.8 feet from station. R.M. 2 is 60.8 feet from station.

**RECOVERY NOTE, TRIANGULATION STATION**

Station reported disturbed. Marker found leaning and later found straightened and reinforced.

**ADJUSTED HORIZONTAL CONTROL DATA**

- **State:** Hawaii
- **Year:** 1914
- **Station:** Kealia USE

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>G-9889</th>
</tr>
</thead>
</table>

- **Geodetic Latitude:** 21° 53' 06.782
- **Geodetic Longitude:** 158° 12' 05.437

- **Planes Azimuths**
  - **PLANE AZIMUTH (From south):** 266° 33' 56"
  - **PLANE AZIMUTH (From north):** 152° 088.4°

- **State Coordinates (field):**

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>437,496.17</td>
<td>152,088.24</td>
</tr>
</tbody>
</table>

- **Plane Azimuth**

  Formula: $A = 69.9^\circ + \theta + \epsilon$

- **Plane Azimuth (Field):** 266° 33' 56"

**GO 176**

**ADJUSTED HORIZONTAL CONTROL DATA**

**HORIZONTAL CONTROL DATA**

- **State:** Hawaii
- **Year:** 1914
- **Station:** Kealia USE

**Recovery Notes:**

- **Recovery Note, Triangulation Station**
  - Station was searched for but none of the marks were recovered. Data obtained from the State Highway Department indicated a mark consisting of a cross on a stone nearby which was tied to the station at one time. This mark was not recovered either. The location of both the station and the cross were determined by traversing from highway survey markers along State Highway 99, and digging was done. A large area along the beach in this vicinity has had the sand stripped from the top and it is believed that all the marks were destroyed.

- **Recovery Note, Triangulation Station**
  - Station reported disturbed. Marker found leaning and later found straightened and reinforced.

**GO 176**

**HORIZONTAL CONTROL DATA**

- **State:** Hawaii
- **Year:** 1914
- **Station:** Kealia USE

**Recovery Notes:**

- **Recovery Note, Triangulation Station**
  - Station was searched for but none of the marks were recovered. Data obtained from the State Highway Department indicated a mark consisting of a cross on a stone nearby which was tied to the station at one time. This mark was not recovered either. The location of both the station and the cross were determined by traversing from highway survey markers along State Highway 99, and digging was done. A large area along the beach in this vicinity has had the sand stripped from the top and it is believed that all the marks were destroyed.

**GO 176**
NO ORIGINAL TEXT


U.S. DEPARTMENT OF COMMERCE - COAST AND GEODETIC SURVEY
RECOVERY NOTE: TRIANGULATION STATION

NAME OF STATION: KAEAMULA (ARMY)
ESTABLISHED BY: U.S.A. YEAR: 1927
RECOVERED BY: U.S.A. YEAR: 1964 COUNTY: Honolulu

Detailed statements as to the status of the original description, including marks found, stencils, changes made, and other pertinent facts:

Station was recovered and is solid in the ground; however, the brass plate was just set on top of the cement, not countersunk. The plate is loose on the stem and can be rotated. The stem is set solidly in the cement. A complete description follows:

Station is located about 5-1/2 miles west-southwest of Wailua, 5 miles east-southeast of Kamae Pt., and 2 miles south of Dillingham Airfield, on a timbered knoll of 1947 feet elevation along the Wai'anae Range.

To reach station from the post office in Wailua, go north on State Highway 90 for 9.1 miles; turn right on paved side road and go 2.0 miles to top of hill and T-junction at a guard shack. Turn right and go 0.6 mile to fork. Take right fork, dirt road, and go 2.6 miles to large cabin on left. Continue ahead on ridge road for 0.2 mile to fork. Take left fork and go 0.6 mile to bare, eroded patch on right, where road passes around point of hill. From here pack south up through trees for about 150 yards to station. Station mark is a 3 x 4-inch brass plate, unstamped, set in cement in the top of a 5-inch soil pipe that projects 6 inches above ground. It is on the narrow, open part of hill at south side of tree line.

*These of details are types a heraldic detail. The officer who actually visited the station should sign his name at the end of the recovery note.

State & Zone Code X Y θ
HI 3 5103 428.147.05 139.902.52 0°04'40"

PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ = θ θ FORMULA REFLECTING THE SECOND TANGENT.

TO STATION OR OBJECT

<table>
<thead>
<tr>
<th>GEODETIC AZIMUTH</th>
<th>PLANAR AZIMUTH</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°00'00&quot;</td>
<td>0°00'00&quot;</td>
<td>0</td>
</tr>
</tbody>
</table>

Q1 386
HORIZONTAL CONTROL DATA

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KEKEKE
YEAR: 1932
THIRD ORDER

NAME OF STATION: KEKEKE
ESTABLISHED BY: H.A.P. YEAR: 1932 STATE: HAWAII
RECOVERED BY: D.G. Rushford YEAR: 1964 COUNTY: Honolulu

HEIGHT OF TELESCOPE ABOVE STATION MARK 1.5 METERS.
HEIGHT OF LIGHT ABOVE STATION MARK METERS.

DISTANCES AND DIRECTIONS TO AZIMUTH MARKS, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION.

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>Bearings</th>
<th>Distance</th>
<th>Bearing</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>KAIHAI 1932</td>
<td>NW</td>
<td>About 3/4 mile</td>
<td>32.08</td>
<td>66.97</td>
</tr>
<tr>
<td>HUNK 1933 R.M. No. 1</td>
<td>NS</td>
<td>About 2 1/2 miles</td>
<td>136.06</td>
<td>0.04</td>
</tr>
<tr>
<td>W.A. Co. Tank</td>
<td>SSW</td>
<td>50.0000'</td>
<td>15.2077</td>
<td>248.24</td>
</tr>
<tr>
<td>R.M. No. 4</td>
<td>SSW</td>
<td>7.0986</td>
<td>15.2077</td>
<td>248.24</td>
</tr>
</tbody>
</table>

Station mark was recovered in poor condition. Station mark is worn and faded. Station mark is short and difficult to see. Station mark is located on the edge of a small hill.

Station mark is a standard disk stamped "KEKEKE 1932 1964", located at the top of a 1/2-inch iron pipe that is set in cement and projects 3 inches above ground. It is 12 yards south of end of ridge.

Reference mark number three is a standard disk stamped "KEKEKE No 3 1932 1964", located 500 feet south of end of ridge.

Reference mark number four is a standard disk stamped "KEKEKE No 4 1932 1964", located 500 feet north of end of ridge.

W.A. Co. Tank is a 48-foot-high cylindrical, silver-colored tank, supported by 4 1-foot legs. It has an inverted 48-foot pipe at the bottom of the tank.

Located 2 1/2 miles east of station, in middle of sugar-cane field, about 0.5 mile south-southeast of State Highway 99.

Note: This mark was recovered from the ground at the station.

Source: G-9885

SATE \ D.ZONE  \ CODE  \ GEOGRAPHIC AZIMUTH (FROM NORTH)  \ PLANE AZIMUTH (FROM NORTH)  \ CODE

| HA 3 | 5103 | 425,332.50 | 148,647.22 | 0 06 47 |

Note: This mark was recovered from the ground at the station.

Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

Source: G-9885
Description of Triangulation Station

Station is located at the northwest tip of Oahu, about 1/2-mile east-southeast of the Kamoa Point Light, at about 270 feet elevation, on steep slope of end of the high ridge, in front of entrance to old tunnel.

To reach station from Wai'Alae High School in Wai'Alae, go west on State Highway 59 for 0.5 miles to Camp Blanding on right. Continue on the highway, which later becomes rough dirt road, for 3.2 miles to fork. 0.2 mile before reaching old beach house on right. Take left fork and go 0.2 mile to end of track 59 at beginning of dirt trail on left. Walk up trail about 1/4-mile to station in front of tunnel and just below old, concrete foundation.

Station mark is a standard disk stamped "KPH 1965", cemented in a drill hole in bedrock flush with ground. It is 16 inches southeast of southeast corner of the concrete walk leading to tunnel door and 3 feet northeast of edge where hill drops down from edge of trail.

Horizontal Control Data

Geodetic Latitude: 21° 34' 33.774"
Geodetic Longitude: 158° 16' 31.811"
HORIZONTAL CONTROL DATA

QUAD 211581
STATION 1095
HAWAII
LATITUDE 21° 30' TO 22° 00'
LONGITUDE 158° 00' TO 158° 30'

ADJUSTED HORIZONTAL CONTROL DATA

<table>
<thead>
<tr>
<th>NAME OF STATION</th>
<th>KPH SEISMOGRAPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE</td>
<td>HAWAII</td>
</tr>
<tr>
<td>YEAR</td>
<td>1965</td>
</tr>
<tr>
<td>CLASS</td>
<td>THIRD ORDER</td>
</tr>
</tbody>
</table>

| GEODETIC LATITUDE | 21° 34' 34.136 |
| GEODETIC LONGITUDE | 158° 16' 51.066 |

<table>
<thead>
<tr>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>METERS</td>
</tr>
<tr>
<td>FNET</td>
</tr>
</tbody>
</table>

STATE COORDINATES (FOOT)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (M.D.)</th>
<th>X ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 3</td>
<td>5103</td>
<td>406,947.17</td>
<td>148,822.48</td>
<td>-0.0605</td>
<td></td>
</tr>
</tbody>
</table>

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE Z OR A FORMULA NEGLECTING THE SECOND TERM.

POSITION DETERMINED BY TRAVERSE FROM STATION KPH
KUILIMA (Hawaii, H.A.F., 1932)--About 1 mile WSW of Kahuku Point, 230 meters NW of the mouth of Kuitila Stream, on a long, narrow, rocky point, 18 meters N of the grass line. Station and R.N.s 1 and 2 are standard disks set in concrete in depressions in outcropping bedrock.

**OBSERVATIONS**

- **Distance** measured:
  - L.A.: 16.63 meters
  - R.N. 1: 16.44 meters
  - R.N. 2: 15.83 meters
- **Height**:
  - High-water line: 23 meters
  - High-water line: 40 meters
  - High-water line: 22 meters
- **Height of signal above station mark**: 3 meters
- **Height of instrument above station mark**: 1.5 meters

**RECOVERY NOTE, TRIANGULATION STATION**

Station has been destroyed. The only mark recovered was reference mark number one.

The correct point for the station was determined by setting a theodolite at the distance of reference mark number one, and on the old angle TIP-OPANA; the coral rock appears to be broken off. The distance and angle for reference mark number two was then laid off from this point and a search made, but it was not found.
HORIZONTAL CONTROL DATA

LAND (Hawaii, H.A.P., 1932) -- Station is 5-3/4 miles E of Kaena Point, about 170 meters N of the O.R.& L. tracks, opposite an emergency landing field. R.N. 1 is 1 foot N of a wire fence.

A U.S.E. (7) survey mark was found 18 meters SW of the station. It is a corrugated-iron pipe filled with concrete with a brass plate in the top.

Station mark is a standard disk set in concrete. Underground mark is a standard disk set in a block of concrete 3 feet below the ground containing at the center of its upper surface a glass bottle with neck projecting a little above the concrete.

OBJECT DISTANCE DIRECTION
CAMP meters 0 0000 0000
R.N. 2 8.69 9 33 30
Storm high-water line 10.00 180
R.N. 1 10.64 200 08 30
Height of signal above station mark -- 3 meters.
Height of instrument above station mark -- 1.5 meters.

(477th FA Obsn. Re, 1946) -- Station is 5-3/4 miles E of Kaena Point, about 170 meters N of railroad tracks, about 400 yards W of the E end of air strip, and 300 yards N of strip. Marks are in good condition.

LAND (Hawaii, H.A.P., 1932) -- Station found, but center disk had been removed. Reference marks found intact.

U.S. DEPARTMENT OF COMMERCE - COAST AND GEODETIC SURVEY
RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: LAND
YEAR: 1932
STATE: Hawaii
COUNTY: Honolulu

Station destroyed. Point is completely torn out. Disc set in concrete found laying approximately 30 feet northwest of original position.

(continued on next page)
LAND (continued)

HORIZONTAL CONTROL DATA
by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

QUAD 211581 STATION 1097
LATITUDE ° / TO °
LONGITUDE ° / TO °
DIAGRAM

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: LAND
Esablished by: H.A.P.  Year 1932  State: Hawaii
Reopened by: W.R. Porter  Year 1963  County: Honolulu

Detailed statement as to the fitness of the original description, including marks found, stampings, changes made, and other pertinent facts:

Station was reported destroyed in 1958.
The only mark recovered was reference mark number two, which appears to be slightly tilted. Station point was determined by distance and angle from this mark, and also by traverse from a nearby pipe marker of the State of Hawaii Survey, and a search made for the underground mark. A 5-foot-deep hole was dug but it was not found. A bulldozer has been in the area and it is believed to have been destroyed.
A cut has been made through the sand dune where the U.S. Engineers mark was located and this mark is believed to have been destroyed.
Sand has been removed from a large area, beginning at the location of reference mark number one and running eastward; this mark could not be found and is believed to have been destroyed.

*Name of chief of party should be inserted here. The officer who actually visited the station should state his name at the end of the recovery note.
Note—One of these notes must be used for every station recovered.
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

SEE STATION MOKULEIA

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LEIA

STATE: HAWAII

YEAR: 1963

SECOND ORDER

SOURCE: 0-12664

NO OBSERVATION CHECK ON THIS POSITION

GEODETIC LATITUDE: 21°34'54.052"

GEODETIC LONGITUDE: 158°10'14.385"

ELEVATION SCALED: 2 METERS

STATE COORDINATES (FHS)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (Hdg, Ht, Angle)</th>
</tr>
</thead>
</table>
| HI 3         | 5103 | 442,013.51 | 150,781.39 | 0°03'46"

PLANE AZIMUTH HAS BEEN COMPUTED BY THE X OR O H Formula neglecting the second term.

TO STATION OR SURVEY

<table>
<thead>
<tr>
<th>PLANE AZIMUTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

POSITION DETERMINED BY TRAVERSE FROM STATION MOKULEIA

QF 571
LENA (Hawaii, H.A.P. 1938) -- Station is 1.6 miles NE of Waimea, midway between Pahu Lema and Paumela Gulches, at crest of bluff about 50 meters N of NE corner of old pineapple field. A prominent wooded knoll is about 120 meters SE of station. The large building N of the highway at Waialae Industrial School (lumber) is visible from station. Station can best be reached by the road the bluff from Waimea.

Station and reference marks 1 and 2 are standard disks set in concrete in depressions in outcropping bedrock.

OBJECT DISTANCE DIRECTION
MAIALEE 0 120 120
R.M. 6 12.14 90 11 30
R.M. 1 11.82 90 26 30

Height of signal above station mark = 3 meters.
Height of instrument above station mark = 1.8 meters.

(477th FA Oban, Nov, 1946) -- Station lost. R.M. 1 and station mark have been destroyed.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: LENA
STATE: Hawaii
YEAR: 1932

Station was searched for but not found. The land in this vicinity has been cultivated and converted to pasture and it is believed that the station and reference marks have been destroyed.

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

**No. of these lines must be used for every station recovered.
Lolo (Oahu Island, L. G. Simmonds, 1927).—In western part of Oahu, on a prominent rise of first ridge south of Makua railroad station, the same ridge on which is situated station Makua 2 (see description thereof), about 1 1/4 miles south and east of Makua railroad station, and 1 mile back from the shore line. Marked according to note 2, a standard disk station mark in outcropping bedrock. Reference marks, note 12A, standard reference disks in outcropping bedrock, are at the following distances and azimuths from the station: No. 1, 43.678 meters (143.30 feet), 280° 29'; No. 2, 1.134 meters (3.72 feet), 357° 00'. Re-marked according to note 14X in 1929.

RECOVERY NOTE, TRIANGULATION STATION

Name of Station: Lolo
Established by: L.G.S.
Year: 1927
State: Hawaii
Recovered by: D.G. Nashford
Year: 1966
County: Honolulu

Station was recovered and all marks found in good condition. A complete description follows:

Station is located about 3 miles north of Makaha village and 1 1/4 miles east of State Highway 90, on a small, sharp, rocky point at about 214 feet elevation along the prominent ridge on the south side of Makaha Valley.

To reach station from the shopping center at Makaha village, go north on State Highway 90 for 3 miles to a truck crossroad at south side of old cemetery, just after crossing bridge. Turn right and follow main track road southeast along base of ridge for 0.9 mile to end of truck travel at parking area on right. Park southerly up side of ridge to station MAKUA 2; then go eastward on trail along crest of ridge for about 1 mile to station. (NOTE: Station can also be reached from end of truck travel by bearing southeast towards the deep saddle about 1 1/4 miles east of MAKUA 2, where there is an old trail. The trail is quite plain part way down from the saddle, but is very faint as it nears the valley floor). Station mark is a standard disk stamped "LOLO 1027", cemented in a drill hole in bedrock. The point on which it is located is about 200 yards west of a higher, grassy knoll that has 2 large, quite prominent bushes on it. The ridge-line makes a distinct change from west to northeast at the station.

Reference mark number one is a standard disk marked "LOLO 01", cemented in a drill hole in a step in a rock ledge at base of steep slope. It is about 7 feet higher than station mark.

Reference mark number two is a standard disk marked "LOLO 02", cemented in a drill hole in the bedrock southeast of the ridge that projects 3 feet above ground on the south side. The mark is at about the same level as station mark.

NOTE: A 2-1/2-hour pack.

None of chief of party should be entered here. The officer who actually visited the station should sign his name as the end of the recovery note.

NOTE: "One of these forms must be used for every station recovered.

*Plane azimuth has been computed by the G-SP156 formula neglecting the second term.

<table>
<thead>
<tr>
<th>STATION OR OBJECT</th>
<th>GEODETIC AZIMUTH (from mark)</th>
<th>PLANE AZIMUTH (from mark)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (CON. &amp; SHALE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI-3</td>
<td>5103</td>
<td>427.853.88</td>
<td>127.335.84</td>
<td>0 04 40</td>
</tr>
</tbody>
</table>
MAHOE (Hawaii, H.A.P., 1938) -- Station is 4-1/4 miles E of Kamoa Point, near W end of Kauai Military Reservation, on the sandy beach about 30 meters N of the railroad tracks.
Surface, underground, and R.N.s 1 and 2 are standard dike set in concrete.
Station MARK is just visible from this station.

<table>
<thead>
<tr>
<th>CREST</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.N. 2</td>
<td>87.89</td>
<td>0° 21' 00&quot;</td>
</tr>
<tr>
<td>R.N. 1</td>
<td>86.49</td>
<td>0° 21' 00&quot;</td>
</tr>
<tr>
<td>High-water line</td>
<td>31</td>
<td>1.80</td>
</tr>
</tbody>
</table>

Height of signal above station mark = 3 meters.
Height of instrument above station mark = 1.8 meters.

(47th FA Obr.Bn., 1948) -- Station is located by red flag on beach. It is encased in 12-inch tile, sunk in beach 400 feet W of air strip and 100 feet N of Highway 11. It is 4-1/4 miles E of Kamoa Point, near W end of Kauai Military Reservation, on the sandy beach, about 30 meters N of railroad. Could not locate reference markers.

---

HORIENTAL CONTROL DATA
by the National Ocean Survey
by the National Ocean Survey
OLD HAWAIIAN DATUM

ADJUSTED HORIZONTAL CONTROL DATA

| NAME OF STATION | MAHOE |
| STATE | HAWAII |
| YEAR | 1938 |
| THIRD |

SOURCE: G-9889

STATE & ZONE CODE X Y E OF OR. H. ANGLE
H1 3 5103 426,675.83 151,426.52 -0° 04' 47"

TO STATION OR OBJECT GEOGRAPHIC AZIMUTH PLAN ARCTIC" CODE
RICE 256 47 25.1 256 52 12 5103

---

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: MAHOE
Established by H.A.P. Year 1938 State: Hawaii
Recovered by G. G. Rushford Year 1964 County: Honolulu

Detailed statement as to the status of the original description; including marks found, stenciling, changes made, and other pertinent facts:
Station was searched for but not found. The exact point was determined by measuring angles to 3 old stations. It was found to be in a sand area that is about 4 feet lower than the original elevation, either due to wave action or sand excavation.
A search was made for the reference marks by distance and angle, but they could not be found.
Station is believed destroyed.