Kala (Kauai Island, F. G. Engle, 1927).—On the west coast of Kauai, Kalalah valley locality, about 12 feet back from bluff line, on a black rock projecting 3½ feet above surface of ground. There are many large black bowlers in surrounding field. The station is reached by landing in a small boat on the sandy beach at the southeastern end of the valley, following a path northwesterly across Kalalah stream to a cabin, thence across the lantana in a northwesterly direction for about 200 meters. Station is marked according to note 3, standard disk in concrete in outcropping bedrock. Reference marks are standard reference disks (note 12g) in very large bowlers projecting about 4 feet above the ground. They are at the following distances and azimuths from the station: No. 1, 5.182 meters (17.01 feet), 243° 41'; No. 2, 4.294 meters (14.09 feet) 318° 53'.

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** KALA  
**STATE:** HAWAII  
**YEAR:** 1927  
**THIRD ORDER**  
**SOURCE:** G-SP156

<table>
<thead>
<tr>
<th>GEOGRAPHIC LATITUDE</th>
<th>GEOGRAPHIC LONGITUDE</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>22° 10' 54.368</td>
<td>159° 39' 12.564</td>
<td>394.0</td>
</tr>
</tbody>
</table>

<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 4</td>
<td>5104</td>
<td>448,086.63</td>
<td>126,821.50</td>
<td>-0 03 29</td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the J. de G. formula neglecting the second term.*

**TO STATION OR OBJECT** | **GEOGRAPHIC AZIMUTH** (From object) | **PLANAR AZIMUTH** (From object) | **CODE**
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Q1 168</td>
</tr>
</tbody>
</table>
Kalalau (Kauai Island, O. B. French, 1910).—On northwest coast of Kauai, on Mount Alealau, on a very bold point at the "maka'i" (seaward) end of the "pali" which runs along the east side of the Kalalau canyon. Approached by a trail along the "pali" from Pihea. Station is on highest point of summit and was on Mount Alealau, on a very bold point at the "maka'i" (seaward) end of the "pali" which runs along the east side of the Kalalau canyon. Approached by a trail along the "pali" from Pihea. Station is on highest point of summit and was:

**Recovery Note, Trig. Station**

**Kalalau**

**Established by**: C.B.F.

**Recovered by**: D.W. Whipp

**Year**: 1910 **State**: Hawaii **County**: Kauai

**Reference Mark**: The 3 reference crosses were not recovered; all the rock is a compressed clay which erodes rapidly due to vegetation growth on it. Station was re-marked with a standard disk, the bottle was used for one reference mark and the old iron pin station mark was used for another reference mark. A complete description follows:

Station is located about 3-1/2 miles northeast of Kokee Park Headquarters, at about 3900 feet elevation, on the extreme north tip of the ridge bordering the east side of Kalalau Valley, in a small patch that is free of vegetation, at the point where the ridge line rises up to the tip.

To reach station from Kokee Park Headquarters, go north on main road for 2.5 miles; take right fork at radar station and go 0.8 miles to dirt road fork at entrance to Kalalau Lookout parking area. Take this right fork and go 2.0 miles to end of road (4-wheel-drive vehicle is required). From here pack easterly on trail through brush for about 1/4 mile to top of first hill and station PIAH. Here leave trail and make way northerly along ridge line, (about 1-1/2 miles airline) to end of ridge and station.

Station mark is a standard disk stamped "Kalalau 1910 1986", secured to the top of a 1-inch iron pipe that is set in cement and projects 4 inches.

Reference mark No. 1 is a bottle, with the neck projecting 3 inches, set at the south side of a lehua stump.

Reference mark number 2 is a 3/4-inch diameter iron pin driven into the ground and projecting 5 inches.

**Notes**: A 2-1/2-hour pack after trail is closed. About 2 days required to clear trail. Helicopter not suitable due to trees and brush.

**Adjusted Horizontal Control Data**

**Name of Station**: Kalalau **State**: Hawaii **Year**: 1910

**Source**: GSP156

**Geodetic Latitude**: 22° 10' 39.333

**Geodetic Longitude**: 159° 37' 44.759

**Elevation (Scaled)**: 1181 Meters 1181 Feet

**State Coordinates (First)**

<table>
<thead>
<tr>
<th>State &amp; Zone Code</th>
<th>x</th>
<th>y</th>
<th>z (ft)</th>
<th>n (inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>456,919.08</td>
<td>125,076.45</td>
<td>0.025</td>
</tr>
</tbody>
</table>

**Notes**: Plane azimuth has been computed by the 2 or 3,1 formula neglecting the second term.
Kalolo (Kauai Island, F. G. Engle, 1927).—On western coast of Kauai, on a dune of the Lapa Dunes. It is reached by following the road past the Barking Sands, northeast through the pasture lands and cane fields as far as it goes. Station is about 50 meters from this road. It is marked by a 2-inch pipe set in a mass of concrete and rocks. A reference mark, note 11c, standard reference disk in concrete mass, was set 8.762 meters (28.71 feet) from station in azimuth 211° 29'.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KALOLO

ESTABLISHED BY: P.O.E.

YEAR: 1927

STATE: Hawaii

BENCH MARKS ALSO

RECOVERED BY: D.H. Whipp

YEAR: 1966

COUNTY: Kauai

Island: Kauai

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

Station was searched for but not found. A trial point was established in the vicinity and the station location determined by inverse from this. Some broken pieces of a stone and concrete monument were found and also a piece of cement bearing the imprint of part of a disk. It is believed that the station is destroyed.
Kila (Kauai Island, O. B. French, 1910).—In northwest Kauai, on Puu o Kila, a peak of the Kaauhola Ridge, about 5 miles northeast of Puu Ka Pele, from which place it shows as a rounding summit with a thin growth of tall trees which stand out against the sky. Station is near the center of the rather flat summit. Marked by cross in top of a stone 4 by 6 by 15 inches set to project 3 inches above the surface. Just alongside and south of it is another stone 18 by 36 by 6 inches which leans against a log. Reference marks, crosses cut in rocks on surface of ground, were at the following distances and azimuths from the station: No. 1, 21.9 feet, 212° 35'; No. 2, 26.0 feet, 278° 39'; No. 3, 35.5 feet, 112° 44'.

KILA (Kauai County, Hawaii, O.B.F., 1910; L.R.L. Rowe, U.S.A.)—Station, a stone with a cross and hole in the top, is badly worn but still in place.

Reference mark 1 is lost (there exists a cross on a stone at 220° 16' and 19.6 ft.). A path has been cut through the recorded position of reference mark 1 and the stone removed.

Reference marks 2 and 3 are lost. Stones in the neighborhood have been moved and broken.

New reference marks were put in 1943:

Reference mark 4 is an iron bolt (3/4- by 34-in.) with a nut on the top 2 in. above ground, near a large tree at 134° 58' and 35 ft.

Reference mark 5 is an iron pipe (3/4- by 36-in.) 2 in. above ground at 220° 09' and 50 ft.

Reference mark 6 is an iron pipe (3/4- by 33-in.) 2 in. above ground, near a large dead tree at 0° 33' and 30 ft.

(continued on next page)
### HORIZONTAL CONTROL DATA

**by the**

**NATIONAL GEODETIC SURVEY**

**OLD HAWAIIAN DATUM**

#### KIIA (continued)

**RECOVERY NOTE, TRIANGULATION STATION**

**NAME OF STATION:** KIIA  
**DATE:** 10-02-74  
**LATITUDE:** 21° 36' 25.4"  
**LONGITUDE:** 158° 05' 01.0"

**ELEVATION ABOVE MSL:** 1832.5  
**WEIGHT OF TELESCOPE ABOVE STATION MARK:** 1.5 KILOGRAMS

**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>READING</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWA 1910</td>
<td>NE</td>
<td>15,336</td>
<td>4,080</td>
</tr>
<tr>
<td>RM No. 1</td>
<td>NE</td>
<td>15,336</td>
<td>4,080</td>
</tr>
<tr>
<td>Ref. Cross # 1</td>
<td>NW</td>
<td>20,586</td>
<td>6,289</td>
</tr>
<tr>
<td>Ref. Cross # 2</td>
<td>E</td>
<td>20,544</td>
<td>7,078</td>
</tr>
<tr>
<td>RM No. 2</td>
<td>NW</td>
<td>35,655</td>
<td>10,350</td>
</tr>
</tbody>
</table>

A shallow 1/4-inch hole at center of a faint cross was recovered and subsequent observations proved this to be the original station mark. Reference crosses # 1 and 2 were recovered, however, the distance and azimuth to cross # 1 did not check very well. Reference cross # 3 was not found. The station was re-marked with a standard disk, and two new reference marks were established. A complete description follows:

Station is located in northwest part of Kauai, about 1-1/4 miles north of Kokee Park Headquarters and 1/2 mile southeast of the Air National Guard site, on a low, flat-topped hill of 4500 feet elevation with some very large trees on it, along Kauaihau Ridge. There is a slightly higher and more conspicuous, sharper topped hill about 250 yards northeast of station, and on opposite side of the Forest Service trail.

To reach station from the Kokee Park Headquarters, go north on closed road for 3.5 miles; take right fork and go 0.2 mile to dirt right fork at entrance to Kauaihau Lookout parking area. Take this right fork and go 0.2 mile; take dim side road right (Forest Service trail) and go 0.7 mile to fork and sign on left "Kauaihau Lookout" and end of truck travel. Pack southerly on dim trail up through brush midway between the trail fork, and then work up through dense brush for about 200 yards to top and station near center of hill. A 15-minute pack.

Station mark is a standard disk stamped "KIIA 1910 1966", cemented in a drill hole in the top of a 4 x 6-inch boulder that projects 2 inches. It is in a small grassy area, the rest of the hilltop being covered with ferns and vines, and is 37 feet southeast of a 50-foot tree, the tallest one on the hill.

Reference mark number one is a standard disk stamped "KIIA 1910 1966", cemented in a drill hole in a 2-foot boulder that projects 10 inches. It is 8 feet southwest of cross # 1.

Reference mark number two is a standard disk stamped "KIIA 1910 1966", cemented in a drill hole in a 2-foot boulder that projects 1 foot. It is 10 feet west of the large Lahua tree.

Cross # 1 is chiseled in the top of a triangle-shaped boulder that projects 2 feet.

Cross # 2 is chiseled in a 10-inch-diameter exposed portion of a boulder, flush with ground.

NOTE: Poles needed for Forest Service trail.

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

---

**USCG NAVDAT NOAA-ASHEVILLE**
HORIZONTAL CONTROL DATA

NAME OF STATION: KOLO
STATE: HAWAII
COUNTY: Kauai

CHIEF OF PARTY: D.J. Flohr
YEAR: 1964
DESCRIPTION: Surveyed by N.S., and others.

HEIGHT OF TELESCOPE ABOVE STATION MARK
METERS


OBJECT
ORIWA
Reference Mark No. 1
Reference Mark No. 2

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

The station is located on the east coast of Kauai Island, on the north end of the island, on the extreme west edge of a prominent mesa of about 1000 feet elevation. There is a deep canyon about 2 miles to the north of the station and a higher point along the bluff to the north. The station overlooks some prominent sand dunes at Pauhau Beach to the east-southeast and a small, almost square, to the north-southeast in the same fields below.

To reach the station from the junction of State Highways 50 and 55 in Kauai, go north on State Highway 55 for 12.8 miles to a dirt road on the left, opposite a paved road leading to a microwave site. Turn left and go downhill for 0.15 mile to a locked wooden gate. Pass through gate and continue on bladed road for 0.25 miles to another locked wooden gate. Pass through gate and continue on bladed road for 0.7 mile to a fork. Take the left fork and continue on bladed road for 0.4 miles to a point where the jeep trail goes up into the mountains and becomes very difficult to follow. From here go westward, through heavy brush, over a hill that has thin timber on top for 1.5 miles to the edge of the bluff and the station, as described below.

The station mark is a standard disk, stamped KOLO 1964, set in a depth of a 5-inch cement-filled post, that projects 10 inches above the surface of the ground. It is fenced in on three sides by a low fence of barbed wire and steel fence posts and is at the west edge of a bar, eroded area of red earth stream with boulders.

Reference mark No. 1 is a standard disk, stamped KOLO NO 1 1964, cemented in a concrete block in a concrete bedrock in a slot in the surface of the ground. It is across a gully from the station mark and about 2 feet higher in elevation. Reference mark No. 2 is a standard disk, stamped KOLO NO 2 1964, cemented in a slot in the west end of a 5-foot by 3-foot box that projects 2 feet above the surface of the ground. It is about 2 feet higher in elevation than the station.

A 4-wheel drive vehicle is required to reach the station.

Keys to the locked gates may be obtained from Mr. Sakai Kole, chief of the survey department of the Kauai Sugar Company in Lihue.

(continued on next page)
KOLO (continued)

HORIZONTAL CONTROL DATA
by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KOLO

ESTABLISHED BY: D.J.P.
RECOVERED BY: D.J.P.

YEAR: 1964
YEAR: 1966
STATE: Hawaii
COUNTY: Kauai
Island: Kauai

HEIGHT OF TELESCOPE ABOVE STATION MARK METERS: 10
HEIGHT OF LIGHT ABOVE STATION MARK METERS: 10

DISTANCES AND DIRECTIONS TO ASSENTH 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>FEET</th>
<th>METERS</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honoulu, AHP, Control Tower 1964</td>
<td>SW</td>
<td>About 4 miles</td>
<td>00 00 00 00</td>
<td></td>
</tr>
<tr>
<td>RM No. 1</td>
<td>NE</td>
<td>50,000</td>
<td>17,078</td>
<td>310 12 55</td>
</tr>
<tr>
<td>RM No. 2</td>
<td>ENE</td>
<td>23,575</td>
<td>7,277</td>
<td>250 13 11</td>
</tr>
</tbody>
</table>

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

Station is located in western part of Kauai, about 2-3/4 miles airline northeast of Mana Village, on edge of mesa, at extreme west end of Kolo Ridge, and at about 1000 feet elevation at the west end of a large, bare, red, eroded area strewn with boulders.

To reach station from the post office in Kekaha, go northwest for 0.2 mile; turn right and follow State Highway 55 for 1.5 miles to side road left and sign "TRAIL NO 2", at Pun RA Pela. Turn left and go 0.2 mile to locked wooden gate. Pass through gate and continue for 2.1 miles to second locked wooden gate. Pass through and continue for 0.7 mile; take left fork and go 0.4 mile to dim right fork. Take right fork and go 8.75 miles to dim bladed crossroad. Continue ahead for 1.0 mile, on road which becomes brushy and dim, to east end of a large, bare, red, eroded area. Leave road and go right, across the red area, for 0.1 mile to station at west end.

Station mark is a standard disk stamped "KOLO 1964", set in the top of a 4-inch cast-iron pipe which is filled with concrete and projects 8 inches. It is surrounded by a 12-foot-square wire fence on 4 metal posts.

Reference mark number one is a standard disk stamped "KOLO NO 1 1964", cemented in a drill hole in the southwest end of a bedrock outcrop that projects 1 feet above ground on the lower side. It is on rock for small gully from station and about 2 feet higher than station mark.

Reference mark number two is a standard disk stamped "KOLO NO 2 1964", cemented in the west end of a large, 5 x 8-foot boulder that projects 2-1/2 feet. It is 6 feet higher than station mark.

NOTE: Key for locked gates may be obtained at the offices of the Kekaha Sugar Company at Kekaha.

*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.
HORIZONTAL CONTROL DATA

QUAD 221593  STATION 1056
HAWAII
LATITUDE 22° 00' 10" 22° 39' 10"
LONGITUDE 156° 30' 10" 156° 30' 10"
DIAMON NF 46  KAUAI

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LAPA
STATE: HAWAII
YEAR: 1967
SECOND ORDER
SOURCE: G-13403

STATES COORDINATES (feet)

<table>
<thead>
<tr>
<th>STATE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>4</td>
<td>406,084.68</td>
<td>80,569.42</td>
<td>-9 00 15</td>
</tr>
</tbody>
</table>

STATE & ZONE CODE

| H1     | 4    | 5104 |

GEODETIC DATA

<table>
<thead>
<tr>
<th>GEODETIC LATITUDE</th>
<th>22° 04' 17.0886</th>
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</thead>
<tbody>
<tr>
<td>GEODETIC LONGITUDE</td>
<td>159° 46' 38.528</td>
</tr>
<tr>
<td>ELATION (feet)</td>
<td>2718 METER</td>
</tr>
<tr>
<td>ELEVATION (feet)</td>
<td>69.2 M</td>
</tr>
</tbody>
</table>

TO STATION OR OBJECT

| TO STATION OR OBJECT | GEODETIC AZIMUTH (from north) | PLANE AZIMUTH (from north) | CODE |
|----------------------|********************************|****************************|------|
| KOLO                 | 264° 23 21.6                  | 264° 29 37               | 5104 |

Note: This area is under construction at this time and the local measurements may be subject to change.

*Refers to gross measurements of triangulation and state establishments of triangulation. **Distance and angle measured clockwise, referred to initial station.

**To ensure every name of triangulation and state establishments of triangulation.
DESCRIPTION OF TRIANGULATION INTERSECTION STATION

NAME OF STATION: Launcher 8A

CHIEF OF PARTY: P.C. Johnson
YEAR: 1967
STATE: Hawaii
COUNTY: Kauai

Description, including sketch of object:
From the Main Gate of the Park Honi Pacific Missile Range Facility, go north along an asphalt road for 2.05 miles to a steel gate at the entrance to a large fenced compound. Continue straight ahead, northwesterly, along an oiled road for 0.05 mile to a "T" intersection. Turn left and go southwest along an oiled road for 0.1 mile to a road on the right. Turn right and go northwest for about 200 feet to the station.

The station is a horizontal steel disk, about 5 feet in diameter, with uprights on either side supporting a large steel tube. Point observed was the center of the horizontal disk.

Note: This is the most southwesterly one of two identical installations in the vicinity.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LAUNCHER 8A

STATE: Hawaii
YEAR: 1967
SECOND ORDER

SOURCE: G-14044

GEODETIC LATITUDE: 22° 03' 48.5002
GEODETIC LONGITUDE: 159° 46' 57.7448
ELEVATION: 4.19 Meters
13.7 Feet

STATE COORDINATES (Feet)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>0</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>404,264.70</td>
<td>83,690.24</td>
</tr>
</tbody>
</table>

\* PLANAR AZIMUTH HAS BEEN COMPUTED BY THE D+W* D FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT | GEODETIC AZIMUTH (From North) | PLANAR AZIMUTH* (From North) |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GF 590</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**HORIZONTAL CONTROL DATA**

**QUAD 211593**
**STATION 1058**
**HAWAII**
**LATITUDE** 22° 00' TO 22° 30' *
**LONGITUDE** 159° 30' TO 160° 00' *
**DIAGRAM** NG 46 KAUAI

**DESCRIPTION OF TRIANGULATION INTERSECTION STATION**

**NAME OF STATION:** Launcher 10A

**CHIEF OF PARTY:** P.C. Johnson  
**YEAR:** 1967  
**STATE:** Hawaii  
**COUNTY:** Kauai

Description, including sketch of objects:
From the Main Gate of the Barking Sands Pacific Missile Range Facility, go north along an asphalt road for 2.05 miles to a steel gate at the entrance to a large fenced compound. Continue straight ahead, northeasterly, along an oiled road for 0.35 mile to a T intersection. Turn left and go southwest along an oiled road for 0.35 mile to a road on the right. Turn right and go northeast for about 200 feet to the station.

The station is a horizontal steel disk, about 5 feet in diameter, with uprights on either side supporting a large steel tube. Point observed was the center of the horizontal disk.

Note: This is the most northeasterly one of two identical installations in the vicinity.

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** LAUNCHER 10 A

**STATE:** HAWAII  
**YEAR:** 1967

**SOURCE:** G-14049

<table>
<thead>
<tr>
<th>STATE CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>404,400.47</td>
<td>83,830.23</td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the D (or G) K FORMULA neglecting the second term.*

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEOGRAPHIC AZIMUTH (true north)</th>
<th>PLANE AZIMUTH (true north)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OF 591
HORIZONTAL CONTROL DATA

DESCRIPTION OF TRIANGULATION INTERSECTION STATION

NAME OF STATION: Launcher 608

CHIEF OF PARTY: P.C. Johnson  YEAR 1967  STATE: Hawaii  COUNTY: Kauai

Description, including sketch of object: From the Main Gate of the Parking Sands Pacific Missile Range Facility, go northerly along an asphalt road for 2.05 miles to a steel gate at the entrance to a large fenced compound. Continue straight ahead, northeasterly, along an oiled road for 0.05 mile to a T-intersection. Turn left and go southwest along an oiled road for 0.15 mile to a road on the right. Turn right and go northeasterly along a dirt road for about 150 feet to the station.

The station is a white-painted steel cylinder, about 7 feet tall, with a conical turret and movable metal boom mounted on top. Tangents were observed on a flange near the top of the turret.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LAUNCHER 608

STATE: HAWAII  YEAR: 1967  SECOND ORDER

SOURCE: G-14044

GEODETIC LATITUDE: 22° 03' 47.6774
GEODETIC LONGITUDE: 159° 46' 58.3443
ELEVATION: 3 METER

STATE COORDINATES (FEET)

<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 4</td>
<td>5104</td>
<td>4043236.41</td>
<td>3627'14</td>
<td>- 3' 30' 22</td>
</tr>
</tbody>
</table>

* Plane Azimuth has been computed by the B or D - A formula neglecting the second term.

TO STATION OR OBJECT | GEODETIC AZIMUTH (true north) | PLANE AZIMUTH' (true north) | CODE
|----------------------|-------------------------------|-----------------------------|------
|                      |                               |                             | OF 592 |
NAME OF STATION: Launcher 609


Description, including sketch of object: From the Main Gate of the Barking Sands Pacific Missile Range Facility, go north of the asphalt road for 2.05 miles to a steel gate at the entrance to a large fenced compound. Continue straight ahead, northerly, along an oiled road for 0.65 mile to a T intersection. Turn left and go southwest along an oiled road for 0.15 mile to a road on the right. Turn right and go northwest along a dirt road for about 0.20 feet to the station.

The station is a white painted steel cylinder, about 7 feet tall, with a conical turret and movable steel boom mounted on top. Point observed was a bolt in the top and center of the launcher.

ELEVATION METER:

STATE COORDINATES (MGRS)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>x</th>
<th>y</th>
<th>z</th>
<th>x-y-z ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1 4</td>
<td>9104</td>
<td>404,212.91</td>
<td>83,811.19</td>
<td>-0 06 23</td>
<td></td>
</tr>
</tbody>
</table>

* Plane altitude has been computed by the E-GRAD-T formula neglecting the second term.

TO STATION OR OBJECT  GEOGRAPHIC AZIMUTH  (FROM EAST)  PLANAR ALIGNMENT

QF 593
**DESCRIPTION OF TRIANGULATION INTERSECTION STATION**

**NAME OF STATION:** Launcher 610

**CHIEF OF PARTY:** P.C. Johnson  
**YEAR:** 1967  
**STATE:** Hawaii  
**COUNTY:** Kauai

Description: Including sketch if available From the Main Gate of the Barking Sands Pacific Missile Range Facility, go northerly along an asphalt road for 2.05 miles to a steel gate at the entrance to a large fenced compound. Continue straight ahead, northeasterly, along an oiled road for 0.05 mile to a "T" intersection. Turn left and go southwest along an oiled road for 0.1 mile to a dirt road on the right. Turn right and go northwest along the dirt road for about 300 feet to the station. The station is a white-painted steel cylinder, about 7 feet tall, with a conical turret and movable steel boom mounted on top. Point observed was a bolt in the top and center of the launcher.

---

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** Launcher 610  
**STATE:** Hawaii  
**YEAR:** 1967  
**SECOND:** 1st

**SOURCE:** G-14944

**DESCRIPTIVE LATITUDE:** 22° 03' 49.1505"  
**DESCRIPTIVE LONGITUDE:** 159° 46' 56.4160"  
**ELEVATION:** 3  
**METERS:** SCALED

<table>
<thead>
<tr>
<th>STATE &amp; CODE</th>
<th>COORD</th>
<th>(X)</th>
<th>(Y)</th>
<th>(\beta) (in degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>404,589.82</td>
<td>83,755.33</td>
<td>-0°06'22</td>
</tr>
</tbody>
</table>

*(PLANE AZIMUTH HAS BEEN COMPUTED BY THE \( \beta = \alpha + \psi \) FORMULA INCLUDING THE SECOND TERM)*

---

**TO STATION OR OBJECT**

**DESCRIPTIVE AZIMUTH** (from north)  
**PLANE AZIMUTH** (from north)  
**CODE**
NAME OF STATION: LAUNCHER 611
STATE: HAWAII
YEAR: 1967
SECOND: 0

ELEVATION: 3 METERS

DESCRIPTIVE LATITUDE: 22° 03' 50.753"
DESCRIPTIVE LONGITUDE: 159° 46' 56.6701"

STATE COORDINATES (Foot)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Φ</th>
<th>Ψ</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>404,306.26</td>
<td>83,935.91</td>
<td>0' 06.22&quot;</td>
<td></td>
</tr>
</tbody>
</table>

*PLAN OF ADDRESS HAS BEEN COMPLETED BY USE OF THE 2 OR 3 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>
<tbody>
<tr>
<td>QF 595</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
HORIZONTAL CONTROL DATA

NAME OF STATION: LAUNCHER 612
STATE: HAWAII
YEAR: 1967
SECOND ORDER

GEODETIC LATITUDE: 22° 03' 50.47" N
GEODETIC LONGITUDE: 159° 44' 54.82" W
ELEVATION: 3 METERS

SOURCE: G-14044

STATE COORDINATES (foot)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (GRP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>404,555,27</td>
<td>83,884,48</td>
<td>-0.06 21</td>
</tr>
</tbody>
</table>

*PLANE AZIMUTH HAS BEEN COMPUTED BY THE Φ (Φ) FORMULA REFLECTING THE SECOND TERM.

<table>
<thead>
<tr>
<th>STATION OR OBJECT</th>
<th>GEODETIC AZIMUTH (from north)</th>
<th>PLANE AZIMUTH (from north)</th>
<th>CODE</th>
</tr>
</thead>
</table>
DESCRIPTION OF TRIANGULATION INTERSECTION STATION

NAME OF STATION: Launcher 613
CHIEF OF PARTY: W. H. Jenkins
YEAR: 1967
STATE: HAWAII
COUNTY: Kauai

Description, including sketch of object: From the Main Gate of the Barber's Sand Pacific Missile Range Facility, go northerly along an asphalt road for 2.05 miles to a steel gate at the entrance to a large fenced compound. Continue straight ahead, northeasterly, along an asphalt road for 0.05 mile to a T-junction intersection. Turn left and go southeast for 0.05 mile to a road on the right. Turn right and go northwest along a dirt road for about 250 feet to the station.

The station is a white painted steel cylinder, about 7 feet tall, with a conical turret and movable steel boom mounted on top. Point observed was a bolt in the top and center of the launcher.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: Launcher 613
STATE: HAWAII
YEAR: 1967
SECOND

SOURCE: G-14044

DESCRIPTIVE LATITUDE: 22°03'52.25"N
DESCRIPTIVE LONGITUDE: 159°46'55.04"W
ELEVATION: 3

STATE & ZONE CODE X SCALE
HI 4 5104 404.519.71 84006.07 0°06.21

STATE COORDINATES (feet):

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X (feet)</th>
<th>SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>404,519.71</td>
<td>84006.07</td>
</tr>
</tbody>
</table>

*PLANE AZIMUTH HAS BEEN COMPUTED BY THE ZO-DE FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT DESCRIPTIVE AZIMUTH (FROM NORTH) PLANE AZIMUTH* (FROM NORTH) CODE

QF 597
DESCRIPTION OF TRIANGULATION INTERSECTION STATION

NAME OF STATION: Launcher 61


Description, including sketch of object: From the Main Gate of the Parking Range Facility, go northward along an asphalt road for 2.05 miles to a steel gate at the entrance to a large fenced compound. Continue straight ahead, northwesterly, along an oiled road for 0.05 mile to a T-intersection. Turn left and go southwesterly for about 100 feet to a road on the right. Turn right and go northeasterly along a dirt road for about 150 feet to the station.

The station is a white painted steel cylinder, about 7 feet tall, with a conical turret and movable steel beam mounted on top. Point observed was a bolt in the top and center of the launcher.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LAUNCHER 61

STATE: HAWAII  YEAR: 1967  SECOND: 1

SOURCE: O-14044

GEODETIC LATITUDE: 22°04’51.7474"
GEODETIC LONGITUDE: 139°46’53.2024"

ELEVATION: 3

STATE CODE: HI

COORDINATES (FROM)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI</td>
<td>4</td>
<td>5134</td>
<td>404,692.59</td>
<td>84,016.82</td>
</tr>
</tbody>
</table>

Plane azimuth was computed by the A. V. D. formula neglecting the second term.

STATE COORDINATES (FROM)

TO STATION OR OBJECT | GEODETIC AZIMUTH | DISTANCE | PLANE AZIMUTH | CODE
|---------------------|------------------|----------|---------------|-------|

OF 568
HORIZONTAL CONTROL DATA

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LAUNCHER 615
STATE: HAWAII YEAR: 1967 SECOND ORDER

Source: C-149

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X (ft)</th>
<th>Y (ft)</th>
<th>Z (ft)</th>
<th>ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>406,344.85</td>
<td>84,349.21</td>
<td>-0 06 21</td>
<td></td>
</tr>
</tbody>
</table>

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

TO STATION OR OBJECT | GEODETIC AZIMUTH (from maker) | PLAN AZIMUTH (from maker) | CODE

OF 595
NAME OF STATION: Launcher 616

CHIEF OF PARTY: P.C. Johnson  YEAR: 1967  STATE: Hawaii  COUNTY: Kauai

Description, including sketch of object: From the Main Gate of the Barking Sands Pacific Missile Range Facility, go northerly along an asphalt road for 2.05 miles to a steel gate at the entrance to a large fenced compound. Continue straight ahead, northwesterly along an oiled road for 0.05 mile to a T intersection. Turn right and go northeast for 0.05 mile to a road on the left. Turn left and go northwest along a dirt road for about 150 feet to the station. The station is a white-painted steel cylinder, about 7 feet tall, with a conical turret and movable steel boom mounted on top. Point observed was a bolt in the top and center of the launcher.

HORIZONTAL CONTROL DATA

NAME OF STATION: Launcher 616

STATE: Hawaii  YEAR: 1967  SECOND ORDER

SOURCE: 0-14044

DESCRIPTIVE LATITUDE: 22° 05' 53.9203
DESCRIPTIVE LONGITUDE: 159° 46' 51.5725

ELEVATION: 3

STATE COORDINATES (feet):

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>2ND. ORDER ANGLE</th>
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</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>404,846.15</td>
<td>84,144.98</td>
<td>0° 06' 20</td>
<td></td>
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</table>

*PLANE AZIMUTH HAS BEEN COMPUTED BY THE 2 ND. ORDER FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT  GEODETIC AZIMUTH  PLAN AZIMUTH  CODE

QF 600
DESCRIPTION OF TRIANGULATION INTERSECTION STATION

NAME OF STATION: Launcher 6109


Description, including sketch of object: From the Main Gate of the Barbers Point Pacifite Missile Range Facility, go northerly along an asphalt road for 2.05 miles to a steel gate at the entrance to a large fenced compound. Continue straight ahead, northeasterly, along an oiled road for 0.05 mile to a "T" intersection. Turn right and go northeast for 0.05 mile to a road on the left. Turn left and go northwest along a dirt road for 0.1 mile to the station. The station is a white-painted steel cylinder, about 9 feet tall, with a conical turret and movable steel boom mounted on top. Tangents were observed on a flange near the top of the turret.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: Launcher 619

STATE: Hawaii  YEAR: 1967  SECOND ORDER

SOURCE: G-14044

DESCRIPTIVE LATITUDE: 22°03'57.5953  ELEVATION: SCALED 5 METERS
DESCRIPTIVE LONGITUDE: 159°46′51.5201

STATE COORDINATES (Foot)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X (FT)</th>
<th>Y (FT)</th>
<th>θ (DEG.}&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>404,851.93</td>
<td>84,606.03</td>
<td>0°06′20″</td>
</tr>
</tbody>
</table>

*PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ = [R.D. + θ] FORMULA NEGLECTING THE SECOND TERM

TO STATION OR OBJECT  DESCRIPTIVE AZIMUTH  (From station)  PLANE AZIMUTH  (From station)  CODE

OF601
Lolo (Kauai Island, O. B. French, 1910).—Near northwest coast of Kauai, wall out on the ridge just west of the Nualolo Canyon. Station is 5 miles from the "pali," and is close to (not identical with) the old station used by the United States Geological Survey. Approached by trail leading up over the Kaunahina Ridge from the paddock east of Halemanu, and thence down the canyon and out the ridge. Marked by a % by 15 inch iron rod driven in flush with ground. The ground is bare at this point and below. Reference marks are as follows: No. 1, cross cut in soft rock, 41.9 feet from the station in azimuth 46° 06'; No. 2, cross cut in rock on surface, 92.1 feet, 118° 27'; No. 3, cross cut in rock on surface, 30.1 feet, 127° 38'. The old geological survey station, marked by a small stone at center of "ahu" (cairn) is 17.2 feet from station in azimuth 285° 24'. In 1927, station was searched for and not found. The old reference marks, crosses cut in rocks, were recovered, but no center mark. A new station was established in this location, marked by a bowlder, and called Lolo E (see description thereof).
Lolo 2 (Kauai Island, F. G. Engle, 1927).—Near northwestern coast of Kauai, on ridge just west of the Nualolo Canyon, 5 miles from the "pali," and close to but not identical with the old station used by the United States Geological Survey. Station is very close to location of old station Lolo 1910, the center mark of which had been destroyed, but the reference marks recovered, though they had apparently suffered some very slight displacement. Station is in small plot of grass; the surrounding ground has been eroded. Reached by the Nualolo trail over the Kaauhuhau Ridge; this trail is marked and kept up by the forest rangers. Marked according to note 4, standard disk in bowlder. Reference marks are standard reference disks (note 120) set in the cross reference marks of 1910. These are at the following distances and azimuths from the station: No. 1, in soft rock, 12.728 meters (41.81 feet), 49° 54'; No. 2, in soft rock, 28.100 meters (92.10 feet), 144° 07'; No. 3, in rock on surface, 0.172 meters (5.69 feet), 270° 22'. The old Geological Survey station, marked by a stone at center of "ahu" (cairn) is 17.2 feet from station in azimuth 202° 04'.

RECOVERY NOTE: TRIANGULATION STATION

NAME OF STATION: Lolo 2
ESTABLISHED BY: F. G. E.
YEAR: 1927
STATE: Hawaii
RECOVERED BY: U.S.G.S.
YEAR: 1962
COUNTY: Kauai
DISTANCE AND DIRECTIONS FROM NEAREST TOWN:

Detailed statement as to the causes of the original destruction, including marks found, analysis, changes made, and other pertinent facts:
Station and K.M. recovered. Both appear to be in place but erosion in area threatens the station.
Located on a flat-topped and fairly bare ridge in NW part of Kauai about one mile from the coast and on the S side of Nualolo Valley and about 3 miles from the Kokee Ranger Station.
Station mark is a USC&GS tablet stamped Lolo 1927 set in concrete and rocks.
(Note: station mark is not stamped Lolo 2). K.M. is a USC&GS reference mark disk stamped Lolo 2 1927 cemented in rock 91.36 feet from station in azimuth 144° 05' 20'.
To reach from the Kokee Ranger station, take the Nualolo trail from a point near the Park Service equipment sheds uphill along old fence to the NW; at top of hill take trail fork to the right and follow trail in and near the drain for about one mile to a point where trail leaves drain and turns uphill to ridge N of drain; follow trail along ridge to trail fork near the head of Kauhoe Valley; take right fork around head of valley and onto the ridge which drops off abruptly into Nualolo Valley on the N; continue N.W. along ridge about 0.50 mile to large flat area and station. A 24-hour pack if trail is open, Local inquiry should be made concerning trail conditions;

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

LOLO 2 (continued)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODetic SURVEY

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: LOLO 2
ESTABLISHED BY: P.O.E.  YEAR: 1927 STATE: Hawaii
RECOVERED BY: D.M. Snipp  YEAR: 1966 COUNTY: Kauai

HEIGHT OF TELESCOPE ABOVE STATION MARK  METERS  HEIGHT OF LIGHT ABOVE STATION MARK  METERS
DISTANCES AND DIRECTIONS TO ASSESS 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>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWA 1910</td>
<td>SSE</td>
<td>9.445</td>
<td>00 00 00.0</td>
</tr>
<tr>
<td>RN No. 4</td>
<td>SSE</td>
<td>9.448</td>
<td>00 00 00.0</td>
</tr>
<tr>
<td>RN No. 5</td>
<td>WNW</td>
<td>9.228</td>
<td>00 00 00.0</td>
</tr>
<tr>
<td>Iron Pin</td>
<td>N</td>
<td>1.285</td>
<td>00 00 00.0</td>
</tr>
</tbody>
</table>

Station mark and reference mark No. 2 were recovered in poor condition. Reference marks No. 1 and 3 have been lost due to erosion. The station mark was re-marked with a disk and two new reference marks were established. A complete description follows:

The station is located in northeast part of Kauai, about 3 miles air-line northwest of Kokee Park Headquarters, at about 2240 feet elevation, on a prominent, bare, red ridge along the southeast rim of Hualolo Canyon, and about 3/4 mile south of the mouth of Hualolo Stream.

To reach station from the Kokee Park Headquarters, go south on highway for about 0.1 mile to end of truck travel and sign on right "HUALOLO TRAIL." Go west directly on good trail about 1-1/2 miles to fork. Take right fork and follow trail about 1 mile to T-junction down on steep hillside. Go left and follow trail about 1/2 mile to open meadow along rim of Hualolo Canyon. Follow down almost to end of meadow, then pick up trail on left and follow around head of timbered ravine and then cut to the open ridge, about 1/8 mile to truck mark.

Station mark is a standard disk stamped "LOLO 2 1927," secured to the top of a 1-inch iron pipe set in a mass of rock and cement, flush with ground. It is on small berm on bare, eroded ridge, 1/2 mile southwest of edge of ridge and 130 feet north of a slightly higher point that is covered with low, dense brush.

Reference mark number four is a standard disk stamped "LOLO 2 1927 4" No. 4 1966, secured to the top of a 1-inch iron pipe that is set in a mass of rock and cement at south end of station bump. It is about 5 inches higher than station mark and projects 2 inches above ground. Reference mark number 5 is a standard disk stamped "LOLO 2 1927 5," cemented in a drill hole in a 2-foot boulder that projects 1 foot above ground. It sets along crest of ridge, 14 feet lower than station mark.

NOTE: Packing time to station is about 2-1/2 hours. End of truck travel is at 3700 feet elevation so return to truck requires more time since station is at about 2840 feet elevation.

* None of chief of party should be inserted here. The officer who actually claimed 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.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: LOLO 2
ESTABLISHED BY: P.O.E.  YEAR: 1927 STATE: Hawaii
RECOVERED BY: F.L. Johnson  YEAR: 1966 COUNTY: Kauai

AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 13 miles north of Kokee

HEIGHT OF TELESCOPE ABOVE STATION MARK  4 FEET  HEIGHT OF LIGHT ABOVE STATION MARK  4 FEET
DISTANCES AND DIRECTIONS TO ASSESS 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>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWA 1910</td>
<td>SSE</td>
<td>9.445</td>
<td>00 00 00.0</td>
</tr>
<tr>
<td>Reference Mark No. 4</td>
<td>SSE</td>
<td>9.445</td>
<td>00 00 00.0</td>
</tr>
<tr>
<td>Reference Mark No. 5</td>
<td>WNW</td>
<td>9.228</td>
<td>00 00 00.0</td>
</tr>
<tr>
<td>Iron Pin</td>
<td>N</td>
<td>1.285</td>
<td>00 00 00.0</td>
</tr>
</tbody>
</table>

The station mark, reference mark No. 4, reference mark No. 5 and the Iron Pin were recovered as described in 1966 and found in good condition. Reference mark No. 6 was established at this time. The horizontal distance and direction to the original reference marks were checked and verified. The 1966 "go judge" was presumed to be adequate as this station was reached by helicopter from FAX Marking Sands at this occupation.

The station is on the northwest part of Kauai, about 3 miles northwest of Kokee Park Headquarters, on a bare, red ridge along the southeast rim of Hualolo Canyon and 3/4 mile south of the mouth of Hualolo Stream.

The station mark, a standard disk stamped LOLO 2 1927 1966, is secured to the top of a 1-inch iron pipe set in a mass of rock and cement and is set flush with the surface of the ground. It is 18 feet southwest of the edge of the ridge and 130 feet north of a slightly higher point that is covered with low, dense brush.

Reference mark No. 4, a standard disk stamped LOLO 2 1927 1966 4, is secured to the top of a 1-inch iron pipe set in a mass of rock and cement and projects 2 inches above the surface of the ground.

Reference mark No. 5, a standard disk stamped LOLO 2 1927 1966 5, is cemented in a drill hole in a 2-foot boulder that projects 1 foot above the surface of the ground. It is about 15 feet lower in elevation than the station mark.

Reference Mark No. 6, a plain bronze disk stamped LOLO 2 1927 1966 5, is set in the top of a 5-inch iron pipe which projects 5 inches above the surface of the ground. It is about 5 feet higher in elevation than the station mark.

* None of chief of party should be inserted here. The person who actually claimed the station should sign his name at the end of the recovery note.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODetic SURVEY
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LUA
STATE: HAWAII
YEAR: 1910
SECOND ORDER

HEIGHT OF EYES ABOVE STATION MARK: 1.5 METERS
HEIGHT OF LIGHT ABOVE STATION MARK: METERS

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>MEASURED</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mākena 2 1927</td>
<td>E</td>
<td>62.480</td>
<td>108° 06' 30&quot;</td>
</tr>
<tr>
<td>HH 3</td>
<td></td>
<td>39.043</td>
<td>134° 18' 38&quot;</td>
</tr>
<tr>
<td>HH 4</td>
<td></td>
<td>20.960</td>
<td>108° 06' 38&quot;</td>
</tr>
</tbody>
</table>

The station and reference mark 3 were recovered and found to be in good condition. The station mark (an iron rod) was replaced with a standard disk secured to a pipe at this time. Reference mark 4 was established at this time. A new description follows:

The station is located 9 miles, air line, north-northeast of Kekaha, 4 miles, air line, east of the west coast of Kauai Island, and 0.2 mile west of State Highway 55. It is on Pu’u Lua Mountain.

To reach the station from the Kokee Park Headquarters, go south on State Highway 55 for 3.7 miles to a dirt road right and sign "Pu’u Lua Reservoir." Turn right and follow the dirt road west for 0.3 mile travel. Take the left fork and go 100 yards to the end of truck highest point of the mountain to the station. A 13-minute pack.

The station mark, a standard disk secured to the top of a 2-inch soil pipe, is stamped LUA 1910 1962. The pipe projects 6 inches above the ground.

Reference mark 3 is a chiseled cross in an 8x10-inch boulder which projects 2 inches above the ground.

Reference mark 4, a standard disk stamped LUA NO 4 1910 1962, is secured to the top of a 2-inch soil pipe which projects 6 inches above the ground.

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

NAME OF STATION: LUA

ESTABLISHED BY: O.B.P.
YEAR: 1910
STATE: Hawaii
COUNTY: Kauai

RECOVERY NOTE, TRIANGULATION STATION
HEIGHT OF TELESCOPE ABOVE STATION MARK: 1.5 METERS
HEIGHT OF LIGHT ABOVE STATION MARK: 1.5 METERS

DISTANCES AND DIRECTIONS TO AZIMUTH MK, 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>OPX 1910 1927</td>
<td>NW</td>
<td>21.020</td>
<td>6,407</td>
</tr>
<tr>
<td>RM 4</td>
<td>E</td>
<td>62.485</td>
<td>19.044</td>
</tr>
<tr>
<td>RM 3</td>
<td>E</td>
<td>62.485</td>
<td>19.044</td>
</tr>
</tbody>
</table>

The station mark, reference mark number 3 and reference mark number 4 were recovered and found to be in good condition. A new description follows.

The station is located 9.0 miles north-northeast of Kekaha, 4.0 miles east of the west coast of Kauai Island and 0.2 mile west of State Highway 55. It is on Puu Lua Mountain.

To reach the station from the Kokes Park Headquarters, go southerly on State Highway 55 for 3.6 miles to a side road right and sign 'Puu Lua Reservoir'. Turn right and follow the dirt road west for 0.3 mile to a fork. Take the left fork and go westerly for 0.1 mile to a road leading to the reservoir, continue westerly for 0.02 mile to end of truck travel. Park west and south up the south side of the mountain to the highest point on the station. A 20-minute pack.

The station mark, a standard disk secured to the top of a 2-inch soil pipe, is stamped LUA 1910 1961. The mark projects 6 inches above the ground.

Reference mark number 3, is a chiseled cross in an 8x10-inch boulder projecting 2 inches above the ground.

Reference mark number 4, a standard disk secured to the top of a 2-inch soil pipe, is stamped LUA 1910 1961. The mark projects 8 inches above the ground.

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

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

RECOVERY NOTE, TRIANGULATION STATION
HEIGHT OF TELESCOPE ABOVE STATION MARK: 1.5 METERS
HEIGHT OF LIGHT ABOVE STATION MARK: METERS

DISTANCES AND DIRECTIONS TO AZIMUTH MK, 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>RM No. 4</td>
<td>NW</td>
<td>20.996</td>
<td>6.297</td>
</tr>
<tr>
<td>RM No. 5</td>
<td>E</td>
<td>62.485</td>
<td>19.044</td>
</tr>
</tbody>
</table>

Station mark and reference mark number 4 were recovered in good condition. Reference cross # 5 was also recovered. A new reference mark, number 5, was established at the point occupied by reference cross # 5.

A complete description follows:

Station is located about 9 miles north-northeast of Kekaha and 7-1/2 miles northeast of Poipu Airfield, on the summit of Puu Lua, a tree-covered hill of about 3476 feet elevation that sets at the northwest side of a reservoir and about 2000 feet west of State Highway 55.

To reach station from the Kokes Park Headquarters, go southerly on State Highway 55 for 3.6 miles to a side road right and a green sign "Puu Lua Reservoir". Turn sharp right and go 0.1 mile to fork. Take right fork and go 0.2 mile to dim crossroad; continue ahead for 0.1 mile to base of hill on right. From here pack westerly up steep hillside to top and station. A 20-minute pack.

Station mark is a standard disk stamped "LUA 1910 1961", braced to the top of a 2-1/2-inch, iron pipe projecting 8 inches from the ground, near west end of hilltop.

Reference mark number 4 is a standard disk stamped "LUA 1910 No 4 1961", braced to the top of a 2-1/2-inch iron pipe projecting 1 foot above ground. It is at the southeast edge of hilltop.

Reference mark number 5 is a standard disk stamped "LUA 1910 No 5 1966", cemented in a drill hole at the center of old reference cross # 5 in the top of a flat rock projecting 2 inches above ground. It is 3 feet lower than station mark and 40 feet south of trail to station.

NOTE - Of these forms must be used for every station covered.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANS AND ATOMIC ADMINISTRATION
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL GEODETIC SURVEY

NOTE - Of these forms must be used for every station recovered.
**HORIZONTAL CONTROL DATA**

**NAME OF STATION:** LUCKY  
**STATE:** HAWAII  
**COUNTY:** Kauai  
**YEAR:** 1966  
**DESIGNED BY:** A.K.R.

**Height of Telescope Above Station:** 2 Meters  
**Height of Light Above Station:** 2 Meters

<table>
<thead>
<tr>
<th>Reference Mark No. 1</th>
<th>Distance (Meters)</th>
<th>Bearing (Degree)</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.483</td>
<td>6.549</td>
<td>000 00 00 00</td>
<td></td>
</tr>
<tr>
<td>22.642</td>
<td>6.858</td>
<td>231 12 28</td>
<td></td>
</tr>
</tbody>
</table>

The station is located on a rocky, eroded point near the end of Makaha Ridge, about 11-1/2 miles north of Kekaha, 7-1/2 miles north-northeast of Sonoma Auxiliary Landing Field and 4 miles west of Kokee Lodge.

To reach the station from the junction of Hawaii State Highways 50 and 35 at Kekaha, go northerly on State Highway 55 for 15.5 miles to an asphalt road on the left. Turn left and go westward, downhill, for 6.5 miles to a bladed road on the left. Turn sharp left and go southwesterly, downhill, for 0.25 mile to a crossroad. Turn right and go southeasterly along a track road for 0.15 mile to the end of the road and the station.

The station mark is a standard disk, stamped LUCKY 1966, cemented in a drill hole in the top of a large boulder that projects 6 inches above the surface of the ground. It is 8-1/2 feet northwest of a wooden witness post with sign.

Reference Mark No. 1 is a standard disk, stamped LUCKY NO 1 1966, cemented in a drill hole in the top of a large boulder that projects 15 inches above the surface of the ground. It is 16 feet south of a wooden witness post with sign and is about 3 feet higher in elevation than the station mark.

Reference Mark No. 2 is a standard disk, stamped LUCKY NO 2 1966, cemented in a drill hole in the top of a large boulder that projects 6 inches above the surface of the ground. It is 26-1/2 feet west-southwest of a wooden witness post with sign and is about 1 foot lower in elevation than the station mark.

**STATE COORDINATES:**

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>H</th>
<th>Y</th>
<th>4° 12' 13.11&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1 4</td>
<td>5104</td>
<td>421,883,70</td>
<td>108,849,56</td>
<td>0° 05' 13&quot;</td>
</tr>
</tbody>
</table>

**Geoetic Azimuth and Plan Azimuth:**

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEOETIC AZIMUTH (From North)</th>
<th>PLAN AZIMUTH (From North)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964 2 USNRD</td>
<td>172 12 06.7</td>
<td>172 17 20</td>
<td>5104</td>
</tr>
</tbody>
</table>

**Note:**

1. The station is on a rocky, eroded point near the end of Makaha Ridge, about 11-1/2 miles north of Kekaha, 7-1/2 miles north-northeast of Sonoma Auxiliary Landing Field and 4 miles west of Kokee Lodge.

2. To reach the station from the junction of Hawaii State Highways 50 and 35 at Kekaha, go northerly on State Highway 55 for 15.5 miles to an asphalt road on the left. Turn left and go westward, downhill, for 6.5 miles to a bladed road on the left. Turn sharp left and go southwesterly, downhill, for 0.25 mile to a crossroad. Turn right and go southeasterly along a track road for 0.15 mile to the end of the road and the station.

3. The station mark is a standard disk, stamped LUCKY 1966, cemented in a drill hole in the top of a large boulder that projects 6 inches above the surface of the ground. It is 8-1/2 feet northwest of a wooden witness post with sign.

4. Reference Mark No. 1 is a standard disk, stamped LUCKY NO 1 1966, cemented in a drill hole in the top of a large boulder that projects 15 inches above the surface of the ground. It is 16 feet south of a wooden witness post with sign and is about 3 feet higher in elevation than the station mark.

5. Reference Mark No. 2 is a standard disk, stamped LUCKY NO 2 1966, cemented in a drill hole in the top of a large boulder that projects 6 inches above the surface of the ground. It is 26-1/2 feet west-southwest of a wooden witness post with sign and is about 1 foot lower in elevation than the station mark.
HORIZONTAL CONTROL DATA

NAME OF STATION: 33 Radar

CHIEF OF PARTY: F.L. Jeffries
YEAR: 1968
STATE: Hawaii
COUNTY: Kauai

DESCRIPTION: The 33 Radar is an 8-foot, white painted mesh dish, mounted on the roof of Van No. 07-19749, which is the second Van North of the northwest corner of the asphalt area. A connection was made to triangulation station BARK 1964, distance being 40.351 meters (132.365 feet) north-northeast of station BARK. Tangents were observed on the base of the radar.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: 33 Radar

STATE: Hawaii
YEAR: 1968
SECOND ORDER:

G-14107

NO OBSERVATION CHECK ON THIS POSITION

DESCRIPTIVE LATITUDE: 22° 01’ 41.25085
DESCRIPTIVE LONGITUDE: 159° 47’ 09.95018

ELEVATION (ft)
S SCALED: 5 Meters

| STATE & ZONE | CODE | X | Y | 5 | Y OR, ft. above
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>403,145.21</td>
<td>70,851.40</td>
<td>0.06</td>
<td>26</td>
</tr>
</tbody>
</table>

* PLANE LENGTH HAS BEEN COMPUTED BY THE S OR, ft. FORMULA NEGLECTING THE SECOND TERM

POSITION DETERMINED BY TRAVERSE FROM STATION BARK
**HORIZONTAL CONTROL DATA**

by the National Geodetic Survey

Maka (Kauai Island, F. G. Engle, 1927).—On the west coast of Kauai, on the shingled beach at Mahana Point. Best reached by small boat in smooth weather. In rough weather it is dangerous to land in the lee of a shelf 1/4 miles northeast of Makaha Point. Marked according to note 3, a standard disk in concrete in bowlder. Two reference marks, note 120, standard reference disks in bowlders, are at the following distances and azimuths from station: No. 1, 16.85 meters (65.3 feet), 277° 30'; No. 2, 14.66 meters (48.1 feet), 333° 49'.

**RECOVERY NOTE, TRIANGULATION STATION**

**NAME OF STATION:** Maka  
**ESTABLISHED BY:** F.G.E.  
**RECOVERY BY:** U.S.G.S.  
**YEAR:** 1927  
**STATE:** Hawaii  
**COUNTY:** Kauai

Detailed statement on the future of the original description: including marks found, condition, changes made, and other pertinent facts:

Station searched for and not found. R.M. 1 and R.M. 2 recovered in good condition.

The station mark was located in an area where high tides and storms could wash it out and it has probably been destroyed.

**RECOVERY NOTE, TRIANGULATION STATION**

**NAME OF STATION:** Maka  
**ESTABLISHED BY:** F.G.E.  
**RECOVERY BY:** D.M. Whipp  
**YEAR:** 1966  
**STATE:** Hawaii  
**COUNTY:** Kauai

Detailed statement on the future of the original description: including marks found, condition, changes made, and other pertinent facts:

Station mark has been destroyed. Both reference marks were recovered in good condition. It is likely that severe wave action has removed the boulder the station mark was in.

R.M. 1 is an unstamped disk cemented in a drill hole in an 8-foot black rock projecting 3 feet. It is 15 feet below cliff base.

R.M. 2 is an unstamped disk cemented in a drill hole in the south-west end of a long, black lava rock ledge running down from cliff edge. It is 30 feet below cliff base and 4 feet above general beach rock line.

---

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** Maka  
**STATE:** Hawaii  
**YEAR:** 1927  
**THIRD ANGLE**

**GEODETIC LATITUDE:** 22° 08' 30.492"  
**GEODETIC LONGITUDE:** 159° 44' 00.901"

**SCALE:** 11"  
**UNIT:** 1000

**STATE COORDINATES:**

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>420,992.43</td>
<td>111,177.00</td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the S. M. O. H. formula neglecting the second term.*

---

**TABLE:**

<table>
<thead>
<tr>
<th>TO STATION OR ORIG.</th>
<th>GEOGRAPHIC AZIMUTH (From north)</th>
<th>PLANE AZIMUTH (From north)</th>
<th>CODE</th>
</tr>
</thead>
</table>

---

**U.S. DEPARTMENT OF COMMERCE**

COAST AND GEODETIC SURVEY

**REPORT NO.** C=64-62  
**DATE:** 1929-08-01

**QUAD 221593**

**STATION 1074**

**HAWAII**

**LATITUDE** 22° 00' TO 22° 30'  
**LONGITUDE** 159° 30' TO 160° 00'  
**DIAGRAM N 4-6 KAUAI**

**Q1 160**
HORIZONTAL CONTROL DATA

Makaha (Kauai Island, O. B. French, 1910)—On west side of Kauai, on a
hump in the Makaha Ridge, about 2 miles west-northwest of Halemanu, and
2 miles " mauka " (landward) slope and is identified with that used by the United States
Geological Survey. The point is practically bare, having only scattering bushes
and a few scrubby koa trees. Approached by the trail down the Miloli Ridge.
Leave this trail about 1/4 mile above signal and cross canyon by climbing down
slide on east side and following pig trail on west. Station marked by X by 15
inch iron rod driven flush with ground. Reference marks were blazes on koa
trees at following distances and azimuths from station: No. 1, 21.4 feet, 265° 30'.
No. 2, 39.3 feet, 330° 00'; No. 3, 71.3 feet, 45° 55'. In 1937 station was searched
for and not found. Reference marks Nos. 1 and 2, blazed in trees, were found,
but in bad condition. A new station was established closely in the position of
the old and called Makaha # (see description thereof).
Makah 2 (Kauai Island, F. G. E. Duke 1927)—In western part of Kauai, on a hump in the Makaha Ridge about 8 miles north-northwest of Hanalei and 2 miles "mukau" (inland) from "palms" along shore. The point is practically bare. It is reached by taking a trail which leaves the main road about 1 mile southwest of Hanalei. Take first fork to the left and continue down the Makaha Ridge. Do not take Miloli trail. Station is close to location of station Makaha of 1910, the center mark of which was not recovered. Marked according to note 4, standard disk in bowlder. There are five reference marks, Nos. 1, 2, and 3 being standard reference disks in bowlders, note 12c, at the following distances and azimuths from the station: No. 1. 2.947 meters (9.03 feet), 19° 21' 29"; No. 2. 2.770 meters (9.09 feet), 26° 44' 29"; and No. 3. 7.854 meters (25.78 feet), 113° 44'. Nos. 4 and 5, identical with reference marks Nos. 1 and 2 of the 1910 station, are blazes on koa trees at the following distances and azimuths from the station: No. 4. 41.30 feet, 268° 27'; No. 5, 39.26 feet, 277° 39'.

The station and reference marks were recovered and found to be in good condition. The difference noted in distance to Reference Mark 3 is believed to be caused by the original measurement probably being a mark to mark measurement. A new description follows.

The station is located 10-1/4 miles, air line, north of Kauai, 2 miles, air line, east of the west coast of Kauai Island, 2 miles, air line, west of State Highway 55, and is on Makaha Ridge.

To reach the station from the Kokee Park Headquarters, go south on State Highway 55 for 1.55 miles to a dirt road right. Turn right and go 0.5 mile to a T-road right. Turn right and go 0.05 mile to a locked gate. (Key may be obtained at Kokee Park Headquarters.) Pass through the gate and follow road westerly for 2.6 miles. Turn right off road and drive to top of small hill and the station, a distance of 0.05 mile.

The station mark, a standard disk stamped MAKHA 1927, is set in a small boulder which projects 5 inches above the ground. It is on the summit of a small knob 150 yards north of the dirt road. The knob has some small brush on top and has red streaks to south.

Reference mark 1, a standard disk stamped MAKHA 1 1927, is set in a small boulder which projects 1 inch above the ground. It is about the same elevation as the station mark.

Reference mark 2, a standard disk stamped MAKHA 2 1927, is set in a small boulder which projects 2 inches above the ground. It is about the same elevation as the station mark.

Reference mark 3, a standard disk stamped MAKHA 3 1927, is set in a small boulder which projects 1 inch above the ground. It is about 2 feet lower than the station mark.

Note: A 4-wheel drive vehicle is required to drive to the station, because of slick and washed out roads.

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

Makaha 2 (continued)

Name of Station: Makaha 2
Established by: R.K.
Chief of Party: D.J. Floriock
Year: 1927
Described by: R.K. Moore

Note: Height of Telescope Above Station Mark

<table>
<thead>
<tr>
<th>Height of Light Above Station Mark</th>
<th>²</th>
<th>Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

Directions and Distances to Adjacent Marks, Reference Marks and Permanent
Objects Which Can Be Seen From the Ground at the Station

<table>
<thead>
<tr>
<th>Object</th>
<th>Bearing</th>
<th>Distance</th>
<th>Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>NARU 1961</td>
<td>ESE</td>
<td>9.344</td>
<td>2.848</td>
</tr>
<tr>
<td>NARU 2</td>
<td>N</td>
<td>8.068</td>
<td>2.774</td>
</tr>
<tr>
<td>NARU 3</td>
<td>WNW</td>
<td>25.710</td>
<td>7.536</td>
</tr>
</tbody>
</table>

The station mark, reference mark number 1, reference mark number 2, and reference mark number 3 were recovered and found in good condition.

The station is located on the west side of Kauai Island, about 2.4 miles east of the west end of the Makaha Ridge, about 3.5 miles southwest of the Ookio Park Headquarters, and 2.5 miles west of State Highway 55.

To reach the station from the Ookio Park Headquarters, go southeast on State Highway 55 for 1.5 miles to a side road. Right and head north on Makaha and Trail road. Continue for 1.5 miles to a locked gate. Continue northwest on the railroad for 2.0 miles to a locked gate. A four-wheel drive truck is required.

The station mark, a standard disk stamped Makaha 1927, is cemented in a drill hole in the top of a small boulder projecting 3 inches above the ground. It is 0.1 mile north of the trail road. Reference mark number 1, a standard disk stamped Makaha 1 1927, is cemented in a drill hole in the top of a small boulder flush with the ground. It is the same elevation as the station. Reference mark number 2, a standard disk stamped Makaha 1 1927, is cemented in a drill hole in the top of a small boulder flush with the ground. It is the same elevation as the station. Reference mark number 3, a standard disk stamped Makaha 3 1927, is cemented in a drill hole in the top of a small boulder flush with the ground. It is the same elevation as the station.

The station mark, reference mark number 1, reference mark number 2, and reference mark number 3 were recovered and found in good condition.

The station is located on an inconspicuous knoll on Makaha Ridge that has been recently planted with pine trees, about 11 miles north of Kauai, 8 miles northeast of Hanalei Park Headquarters, and 2.2 miles west-northwest of Hanalei State Highway 55.

To reach the station from the Junction of State Highways 50 and 55 at Kauai, go north on State Highway 55 for 15.5 miles to an asphalt road on the left. Turn left and go west, about 2.5 miles. Turn right and go west, cross-country, for 0.1 mile to the summit of the knoll and the station.

The station mark is a standard disk, stamped Makaha 1927, cemented in a drill hole in the top of a small boulder that projects 9 inches above the surface of the ground. It is 11-1/2 feet north-northeast of a wooden witness post with sign.

Reference mark No. 1 is a standard disk, stamped Makaha 1 1927, cemented in a drill hole in the top of a small boulder that projects 1 inch above the surface of the ground. It is 14-1/2 feet north-northeast of a wooden witness post with sign and about the same elevation as the station mark.

Reference mark No. 2 is a standard disk, stamped Makaha 1927, cemented in a drill hole in the top of a small boulder that projects 3 inches above the surface of the ground. It is 3 feet north-northeast of a wooden witness post with sign and about the same elevation as the station mark.

Reference mark No. 3 is a standard disk, stamped Makaha 1 1927, cemented in a drill hole in the top of a small boulder that projects 2 inches above the surface of the ground. It is 29-1/2 feet north-northeast of a wooden witness post with sign and about 1-1/2 feet lower in elevation than the station mark.

Note: Chief of party should be instructed here. The officer who actually visited the station should sign his name at the end of the recovery note.
HORIZONTAL CONTROL DATA
by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

MAKAHA 2 (continued)

NAME OF STATION: MAKAHA 2
YEAR: 1927
STATE: Hawaii
COUNTY: Oahu
ISLAND: Oahu

RECOVERY NOTE, TRIANGULATION STATION

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>MEASUREMENT</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWAA 1910</td>
<td>ESR</td>
<td>0.333</td>
<td>0 0 0 0 0</td>
</tr>
<tr>
<td>RM No. 2</td>
<td>S</td>
<td>0.076</td>
<td>2 7 6 6 1 2</td>
</tr>
<tr>
<td>RM No. 3</td>
<td>NW</td>
<td>25.666</td>
<td>7 3 2 2 2</td>
</tr>
</tbody>
</table>

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

Station is located about 1 mile north of Makaha and 2 miles west-northwest of the Koko Tracking Station, at about 200 feet elevation, on a prominent point on Makaha Ridge, along the north side of a new macadam road.

To reach station from the post office in Koko, go northwest for 0.8 mile; turn right and follow State Highway 85 for 4.5 miles to macadam 7-road left. Turn left and follow this road (Makaha Ridge Road) for 2.5 miles; turn right, off of macadam road and go westward along open flat area for 0.1 mile to station.

Station mark is a standard disk stamped "MAKAHA 1927", cemented in a drill hole in a 10-inch boulder that projects 1 inches. It is 11.6 feet north of a white witness post and about 60 yards north of macadam road. Reference mark number one is a standard disk stamped "MAKAHA 1 1927", cemented in a drill hole in a 6-inch rock that projects 1 inch. It is about 6 inches higher than station mark.

Reference mark number two is a standard disk stamped "MAKAHA 2 1927", cemented in a drill hole in a 10-inch boulder that projects 2 inches. It is 3 feet northeast of the witness post and about 6 inches lower than station mark.

Reference mark number three is a standard disk stamped "MAKAHA 3 1927", cemented in a 6-inch, exposed section of bedrock that projects 2 inches. It is 25 feet east from end of hill and about 2 feet lower than station mark.

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

Makaha 2
Reestablished by P.O.E.
Year: 1927
State: Hawaii
County: Oahu
Island: Oahu

All marks found in good condition. Previous description by D.M. Whipp is adequate. The open flat area mentioned in the to reach portion of the description is now covered with a new growth of evergreen trees spaced 5 feet apart. After following Makaha Road further for 2.5 miles, park westward about 500 feet to open unplanted area and station near edge of ridge running about in a north-south direction and about perpendicular to and north of first sharp curve of road west of end of truck travel. It is possible, however, to drive a jeep type vehicle between the trees to station after clearing the brush.

A Type A station with side walls built of concrete tile blocks with a 3 foot concrete observing platform about 3 feet above ground level has been constructed over the station mark as well as a metal target. The station mark is exposed at ground level and accessible for inspection. This work was done on August 12, 1971.
NAME OF STATION: Makana
YEAR: 1910
STATE: Hawaii
ISLAND: Kauai
COUNTY: Kauai

Station was identified and is in good condition. Located about 3-1/2 miles west-northwest of Hanalei, at Kaliiu Point, on north end of the ridge on west side of Limahuli Stream. Station is a slightly round-topped peak, or spine, of about 1100 feet elevation, with sides rising almost straight up.

NOTE: This peak was intersected again in 1927 and named Flat 1927; both stations are identical.

Station was observed from vicinity of station MAKANL, looking westward.

- Plane azimuth has been computed by the ZHA formula neglecting the second term.
HORIZONTAL CONTROL DATA

NAME OF STATION: MAKAW
STATE: HAWAII
COUNTY: Kauai

DESCRIPTION OF TRIANGULATION STATION

NOTE: HEIGHT OF TELESCOPE ABOVE STATION MARK 3 METERS.
HEIGHT OF LIGHT ABOVE STATION MARK 3 METERS.
DISTANCES AND DIRECTIONS TO ADJACENT MARKS, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

OBJECT
BEARINGS
DISTANCE
DIRECTIONS

MAKAW 2 1027
Cliff (pipe)
N 22.20° E 6.767°

12c Reference Mark No. 2
NW 28.59°
N 55 37

12a Reference Mark No. 1
ENE 19.125°
N 5.633°

The station is 13 miles north of Kekaha, 4.5 miles west of State Highway 55, on Makaha Ridge at the west end of Kauai Island and at the west end of a radar complex.

To reach the station from the junction of State Highway 50 and 55 in Kekaha, go north on State Highway 55 for 5.0 miles to an asphalt road on the left. Turn left and follow the asphalt road down the ridge for 5.1 miles to the end of the road at the station as described.

The station, a standard disk stamped MAKAW 1964, is set in the top of a 12-inch round concrete monument which projects 7 inches above the surface of the ground. It is 3 feet north-northeast of a 4 by 4-inch white witness post and sign. Note: The underground disk is stamped MAKAW 1966.

Reference mark No. 1, a standard disk stamped MAKAW NO 1 1966, is cemented in a drill hole in outcropping bedrock. It is 19.7 feet east-northeast of the 4 by 4-inch white witness post and sign and is 6 inches higher in elevation than the station mark.

Reference mark No. 2, a standard disk stamped MAKAW NO 2 1966, is cemented in a drill hole in a boulder which projects 6 inches above the surface of the ground. It is 21.4 feet west-northwest of the 4 by 4-inch white witness post and sign and is 3 feet lower in elevation than the station mark.

Cliff, a survey point of undetermined denomination is a 3/4-
inch galvanized pipe which projects 4 inches above the surface of the ground.

Note: This area is under construction at this time and is subject to change.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: MAKAW
STATE: HAWAII
YEAR 1966
SECOND ORDER

SOURCE: C-1372

GEODETIC LATITUDE: 22° 39' 17.0854
GEODETIC LONGITUDE: 159° 43' 52.5041
ELEVATION: 453.40 METERS
1487.5 FEET

STATE COORDINATES (FT)

<table>
<thead>
<tr>
<th>HI</th>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>5104</td>
<td>421,730.90</td>
<td>110,824.24</td>
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</tr>
</tbody>
</table>

PLANAD Azimuth has been computed by the \( \tan^{-1} \) formula neglecting the second term.

TO STATION OF OBJECT

<table>
<thead>
<tr>
<th>MAKAW 2</th>
<th>GEOF Azimuth (From north)</th>
<th>PLANE Azimuth* (From north)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>296 58 31.5</td>
<td>297 03 46</td>
<td>5104</td>
<td></td>
</tr>
</tbody>
</table>

*Notes to notes in appendix of triangulation and notes of triangulation. If direction angle is measured clockwise, refer to initial station.
Māna (Kauai Island, O. B. French, 1910).—On west coast of Kauai, on a low sand hill 1½ miles north of the ford at the outlet to the big pond and 2 miles south of "Barking Sands." Station is on loose rocks in top of sand dune and is marked by a drill hole in flat rock. Reference marks were established as follows: No. 1, cross in rock 12.0 feet from station in azimuth 205° 40'; No. 2, cross cut in small rock 6 by 6 by 10 inches set flush with ground at edge of sod, 128.5 feet, 28° 22'; No. 3, cross in rock, 42.2 feet, 177° 28'. In 1927 station was searched for and not found. Crumbly sandstone is in the vicinity. A 2-inch iron pipe was found, and a new station established over it and called Māna 2 (see description thereof). A standard disk station mark was placed in the pipe and it was surrounded with stones and concrete.
HORIZONTAL CONTROL DATA

Mauna 2 (Kauai Island, F. G. Egle, 1927).—On western coast of Kauai, 1 mile west of Mauna, on a low sand hill about 150 meters south of a pasture fence and near a clump of agave trees. Reached by taking the Kauai Sands road from Mauna and turning left when the road approaches the shore. Station is 42.59 meters from mean high water. Marked according to note 6a, a standard disk being cemented into a 2-inch iron pipe which was found already in place. A pile of rocks was placed around it and the mass cemented together. The iron in which the station and reference marks were set is a light crumby sandstone. The reference marks, note 12a, standard reference disks in outcropping bedrock, are at the following distances and azimuths from the station: No. 1, 3.06 meters (12.99 feet), 46° 49'; No. 2, 4.335 meters (14.22 feet), 170° 46'.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: Mauna 2
ESTABLISHED BY: F.G.E.
YEAR: 1927
STATE: Hawaii
COUNTY: Kauai
Bench Marks Also:

AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: Detailed statement as to the features of the original description, including marks found, markings, changes made, and other pertinent facts.

Search for not found, the station could be found was probably destroyed by construction work around Bohnam Naval Airfield.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: Mauna 2
ESTABLISHED BY: F.G.E.
YEAR: 1927
STATE: Hawaii
COUNTY: Kauai
Bench Marks Also:

AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: Detailed statement as to the features of the original description, including marks found, markings, changes made, and other pertinent facts.

Station is gone. A new station, BONHAM 1961, has been established nearby, and a search was made by distance and azimuth from it, but none of the marks of Mauna 2 were found.
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

QUAD 221S93
HAWAII
LATTITUDE 22° 00' TO 22° 30'
LONGITUDE 155° 30' TO 160° 00'
DIAGRAM MF 4-6 KAUM

STATION 1081

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: MFS-25 Feedhorn

STATE: HAWAII
YEAR: 1967
SECOND ORDER

NO OBSERVATION CHECK ON THIS POSITION

GEODETIC LATITUDE: 22° 01' 55.58"N
GEODETIC LONGITUDE: 156° 47' 09.11"W
ELEVATION: 56.85 METERS

STATE COORDINATES (FLAT)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>x (meters)</th>
<th>y (meters)</th>
<th>z (meters)</th>
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<tbody>
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<td>5104</td>
<td>403,173.68</td>
<td>1,297.41</td>
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* PLANE AZIMUTH HAS BEEN COMPUTED BY THE Z CHORD FORMULA NEGLECTING THE SECOND TERM.

POSITION DETERMINED BY TRAVERSE FROM STATION CABLE

QF 585
HORIZONTAL CONTROL DATA

NAME OF STATION: MPS 26 RADAR
STATE: HAWAII
YEAR: 1968
SECOND ORDER

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: MPS 26 RADAR
STATE: HAWAII
YEAR: 1968
SECOND ORDER

NO OBSERVATION CHECK ON THIS POSITION

DESCRIPTIVE LATITUDE: 22° 01' 41.5521'N
DESCRIPTIVE LONGITUDE: 159° 47' 38.7148'W
ELEVATION: 9 METERS

STATE & ZONE COORDINATE (METERS)

<table>
<thead>
<tr>
<th>STATE ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>ELEVATION</th>
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</thead>
<tbody>
<tr>
<td>HI G</td>
<td>5104</td>
<td>403,108.44</td>
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*PLANE AZIMUTH HAS BEEN COMPUTED BY THE T - 0 FORMULA NEGLIGENT THE SECOND TERM*

TO STATION OR OBJECT

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

POSITION DETERMINED BY TRAVERSE FROM STATION BARK
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

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

NAME OF STATION: MPS 26 RADAR 323102

CHIEF OF PARTY: W.E. Simmons

YEAR: 1966

STATE: Hawaii

COUNTY: Kauai

Description, including sketch of object:
6.95 miles northwest along State Highway 50 from
the junction with State Highway 55 at Kekaha, thence 0.4 mile west
along the left fork to the main gate at Bonham Auxiliary Landing
Field, thence 0.8 mile south along an oiled road, thence 0.1 mile
west along an oiled road, thence 0.05 mile south along an oiled road,
in a paved parking area, 53 feet west of a machine shop, 23 feet
north of a generator, 15.5 feet east of an electric outlet. The
mark is plain brass disk, stamped MPS 26 RADAR 1966, set in the top
of a small concrete plug that is flush with the surface of the
asphalt.

A traverse connection was made to traverse station MPS 26 RADAR
323101 1965, distance being 12.8687 meters (42.220 feet) northeast
of traverse station MPS 26 RADAR 323101 1965.

Described by

JUN 1978

HAWAII

LATITUDE 22° 00' TO 22° 30'

LONGITUDE 159° 30' TO 160° 00'

DIAGRAM 46-6

Kauai

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION
MPS-26 RADAR 323102

GEODETIC LATITUDE: 22°01.42', METER
GEODETIC LONGITUDE: 159°47.08', METER

STATE: HAWAII

YEAR: 1966

SECOND ORDER

NO OBSERVATION CHECK ON THIS POSITION

GEODETIC COORDINATES (METERS)

STATE & ZONE CODE X Y Z COORD. OF ANGLE

HI 4 5104 403,254.45 70,975.84 - 0°06'.26

PLANE AZIMUTH HAS BEEN COMPUTED BY THE SECOND ORDER FORMULA,NEGLECTING THE SECOND TERM

POSITION DETERMINED BY TRAVERSE FROM STATION MPS-26 323101

OF 470
HORIZONTAL CONTROL DATA

TRAVELLED

NAME OF STATION: HW ANT DISH

CHIEF OF PARTY: Phillip G. Johnson Year: 1967
STATE: Hawaii
COUNTY: Kauai

DESCRIPTION OF TRAVELLED CONTROL STATION

15.5 miles north along State Highway 55 from the junction of State Highway 50 and 55 in Kakaako, thence 5 miles west down the ridge on an asphalt road.

A traverse connection was made to triangulation station ADOBE, distance being

north of triangulation station ADOBE. This mark is a plain bronze disk set in the top of a mass of concrete. It is 1 foot south of the south side of a triangular shaped tower which is located near the east corner of the communications building. This point is plumbed directly under the center of the gray microwave dish.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: HW ANT DISH

STATE: HAWAII
YEAR: 1967
SECOND ORDER

NO OBSERVATION CHECK ON THIS POSITION

GEOGRAPHIC LATITUDE 22° 06' 11.7616
GEOGRAPHIC LONGITUDE 159° 43' 48.7226

ELEVATION 465.06 Meters
1538.8 Feet

STATE COORDINATES (Feet)

STATE ZONE CODE X Y Z\(^d\) X Y Z\(^d\)
HI 4 5104 424,085.52 110,225.53 - 0 05 12

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE Z-U-\(\phi\) FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT GEOGRAPHIC AZIMUTH (From North) PLANE AZIMUTH (From North) CODE

POSITION DETERMINED BY TRAVEL FROM STATION ADOBE

QF 520
HORIZONTAL CONTROL DATA

Na (Kauai Island, O. B. French, 1910).—In northwest part of Kauai, on a low
summit of the ridge which runs north through the Na Pali district. Approached
by a trail leading along the ridge over numerous hills from the main trail along
the Kauauma Ridge; the trail leaves this latter on the easterly of the three
summits called Pikes about 600 meters east of the station. Station marked by
a ½ by 18 inch iron rod driven flush with the surface of the ground (clay), from
which moss, roots, and humus had been struck. Reference marks were estab-
lished as follows: No. 1, iron rod ¾ by 18 inches driven into cleared ground with
2 inches projecting; it is 1.5 feet from station, in azimuth 225°; No. 2, nail
driven into a nearly vertical cut in large blue root at edge of cleared spot, 3.5
feet, 91°; No. 3, five nails driven into smoothed-off top of 10-inch blue stump
20 feet from ground, 9.4 feet, 19° 59'.

RECOVERY NOTE. TRIANGULATION STATION

Na

Name of Station: NA
Established by: O.B.P.
Year: 1910
State: Hawaii
County: Kauai
Island: Kauai

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

Original station mark and reference mark 1, both iron rods, were re-
covered in good condition. Station rod was removed and station re-marked
with a standard disk; the rod was used for reference mark 2. A complete
description follows:

Station is located in the northwest part of Kauai, about 4 miles air-
line northeast of Kokee Park Headquarters, on a point of about 4940 feet
elevation on a narrow winding ridge that runs northeast from the main
Kauauma Ridge, beginning at the second peak east from station PINEA. It
is about 600 feet north of a prominent, and slightly higher, tree-covered
point on the small point where the ridge line makes a turn from
north to northeast, leading towards station 52. The vegetation and humus
were stripped from the point when the station was set in 1910 and an
8 x 18-foot patch still remains free of vegetation, although it now has
an 8-inch layer of brown humus on the clay soil.

To reach station from the Kokee Park Headquarters, go north on paved
road for 2.5 miles; take right fork at radar station and go 0.5 mile to
dirt right fork at entrance to Kalalau Lookout parking area. Take this
right fork (a 4-wheel-drive vehicle is required) and go 2.5 miles to end
of road. From here park easterly on trail for about 1/4 mile to station
PINEA; continue on trail about 1/4 mile, to top of second peak. Leave
trail, going to left down along ridge line, difficult to find; cross
saddle and follow along the narrow winding ridge line for about 2 miles
to station 500 feet after reaching the higher peak. A 2-1/2-hour hike
after trail is cleared; about 2 days required to clear trail through dense
underbrush.

Station mark is a standard disk stamped "NA 1910 1966", riveted to
the top of a 1-inch iron pipe set in cement and projecting 4 inches, at the
center of the 8 x 12-foot bare patch.

Reference rod # 1 is a 3/4-inch diameter iron rod, flush with clay
surface beneath 8-inch humus layer.

Reference rod # 2 is a 3/4-inch iron rod, 15 inches long, driven into
the ground with 2 inches projecting. It is 6 feet east of trail, at
entrance to the bare patch.

<table>
<thead>
<tr>
<th>Reference Rod</th>
<th>Length (ft)</th>
<th>Azimuth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference rod # 1</td>
<td>0.396</td>
<td>125°</td>
</tr>
<tr>
<td>Reference rod # 2</td>
<td>1.686</td>
<td>6.533</td>
</tr>
</tbody>
</table>
Niha 2 (Kauai Island, F. G. Engle, 1927).—On north coast of Kauai, on west side of Wainiha Bay, on a sandy point named Repuhi, about 1 mile northwest of the village of Wainiha, and ½ mile from the government highway. Station is about 10 meters from high-water line and is marked by a standard disk station mark driven in the top of a wooden post which projects 1 foot above surface. Reference mark No. 1 is a standard disk set in top of a wooden post which projects 1 foot above ground; it is 5,626 meters (18,46 feet) from station in azimuth 148° 29' (120° 01') from station in azimuth 263° 46'.

RECOVERY NOTE. TRIANGULATION STATION

NAME OF STATION: NIHA 2
ESTABLISHED BY: F. G. Engle YEAR: 1927
RECOVERED BY: D. W. Whipp YEAR: 1955
STATE: Hawaii COUNTY: Kauai

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

Station is destroyed. The point where it was located was determined by angle check, using HANALEI, WAINIHA and inverse azimuth to Staff, 1927. The sand beach has worn away a few feet inland from this point and as both reference marks were seaward from station they are also gone.
Nohili (Kauai Island, O. B. French, 1910).—On west coast of Kauai, on the highest summit of the sand ridge where the shore line turns from north to northeast. The station is near the old Hawaiian Government Survey station, the 1-inch pipe marking the latter having been pulled out or underestimated. This pipe was driven in to mark the new station. In 1910 the old Barking Sands flag was still standing on a summit about 100 meters to the south. Reference marks were set as follows: No. 1, cross cut in stone set in the sand, distance 39.8 feet, azimuth 17° 44'; No. 2, cross cut in stone set in the sand, 27.4 feet, 38° 07'; No. 3, cross cut in stone set in the sand, 20.8 feet, 207° 00'. In 1927 a 3-inch pipe found in the vicinity, but not on highest point of sand dune, proved not to be original station. No reference marks were found. A new station was established over the 3-inch pipe and called Nohili # (see description thereof).

<table>
<thead>
<tr>
<th>NAME OF STATION</th>
<th>NOHILI</th>
<th>STATE</th>
<th>HAWAII</th>
<th>YEAR</th>
<th>1910</th>
<th>THIRD</th>
<th>&quot;UNDER&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOURCE</td>
<td>G-SPI156</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**HORIZONTAL CONTROL DATA**

<table>
<thead>
<tr>
<th>GEOGRAPHIC LATITUDE</th>
<th>22° 04' 01.978</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOGRAPHIC LONGITUDE</td>
<td>159° 47' 06.990</td>
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</tbody>
</table>

**STATE COORDINATES (FMS)**

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>E OR D. M. ANGLE *</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>403.357.52</td>
<td>85.021.32</td>
<td>0° 06' 26&quot;</td>
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* PLANE AZIMUTH HAS BEEN COMPUTED BY THE 2 ORD. M. FORMULA NEGLECTING THE SECOND TERM

**TO STATION OR OBJECT**

<table>
<thead>
<tr>
<th>GEOGRAPHIC AZIMUTH (FROM SINGLE)</th>
<th>PLANE AZIMUTH (FROM SINGLE)</th>
<th>CODE</th>
</tr>
</thead>
</table>

**Q1 173**
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

NOHILI 2 (Kauai Island, F. G. Engle, 1927)—On the western coast of Kauai, on the highest point of the Barking Sands. Station is reached by the Barking Sands road from Mana; turn to the right as the shore line is approached. The road leads to a pavilion at the base of the dunes of the Barking Sands; station is 200 meters north of this pavilion. Marked according to note 6A, a bronze disk being placed in a 3-inch pipe which was already in place, and a sheet iron cylinder about 8 inches in diameter placed around it and filled with concrete. Reference mark, note 15A, a standard reference disk in a tile was placed 5.717 meters (18.78 feet) from station in azimuth 31° 20'.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: NOHILI 2
Established by: F.G.E. Year: 1927 State: Hawaii
Recovered by: F. J. Taylor Year: 1966 County: Kauai

Detailed statement as to the flaws of the original description; including marks found, measurements changed, and other pertinent facts:

Station destroyed. Found disk at dump which was turned in by Coast Guard Officer.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: NOHILI 2
Established by: F.G.E. Year: 1927 State: Hawaii
Recovered by: D.M. Whipp Year: 1966 County: Kauai
Airline distance and direction from nearest town: Island: Kauai

Detailed statement as to the flaws of the original description; including marks found, measurements changed, and other pertinent facts:

Previously reported destroyed in 1962. A check by distance and angle from station CANUTE (S & N) was made and the sand dune found to be worn down where the station was located.

---

### ADJUSTED HORIZONTAL CONTROL DATA

<table>
<thead>
<tr>
<th>NAME OF STATION</th>
<th>NOHILI 2</th>
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<tbody>
<tr>
<td>STATE</td>
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<tr>
<td>YEAR</td>
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<td>SECOND</td>
<td>ORDER</td>
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**SOURCE**

G-SP156

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</thead>
<tbody>
<tr>
<td>GEOGRAPHIC LONGITUDE</td>
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<tr>
<td>ELEVATION (feet)</td>
<td>24</td>
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<tr>
<td>SCALED (METERS)</td>
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### STATE COORDINATES (Feet)

<table>
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<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>G X Y 0.1 DEG ANGLE</th>
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* PLANE AZIMUTH HAS BEEN COMPUTED BY THE & G. G. S. FORMULA, NEGLECTING THE SECOND TERM.

### TO STATION OR OBJECT

<table>
<thead>
<tr>
<th>GEODETIC AZIMUTH</th>
<th>PLANE AZIMUTH</th>
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</thead>
<tbody>
<tr>
<td>(FROM STATION)</td>
<td>(FROM STATION)</td>
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<table>
<thead>
<tr>
<th>CODE</th>
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U.S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

JUNE 1978

NATIONAL GEODETIC SURVEY
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

PAIR 221593
STATION 1089
HAWAII
LATITUDE 22° 03' 12.2433" N
LONGITUDE 21° 45' 21.6130" W

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: OHAIULA
STATE: HAWAII
YEAR: 1964
SECOND ORDER
SOURCE: G-13403

TRIANGULATION STATION
NAME OF STATION: OHAIULA
STATE: HAWAII
COUNTY: Kauai
CHIEF OF PARTY: D.R. Fiebich
YEAR: 1964
DESCRIPTION BY: E.R.

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

OBJECT

REFERENCE MARK No. 1
Bonham AIF Control Tower
REFERENCE MARK No. 2

MEASURED DISTANCE IN FEET
23,999
26,996

DISTANCE IN METER
7,297
8,220

DIRECTION
000° 00' 00" 04° 58' 23° 03' 03.3"

The station is located on the west end of Mana Ridge, which is part of a prominent mass on the west side of Kauai Island. It is about 2 miles east of the Sandia Corporation's Harling Sandia Mine Site.

To reach the station from the junction of State Highways 50 and 55 in Lihue, go northward on State Highway 55 for 2.8 miles to a dim bladed road on the left. Opposite a paved road leading to a microwave site. Turn left and go downhill for 0.15 mile to a locked wooden gate. Pass through gate and continue on the bladed road for 2.25 miles to another locked wooden gate. Pass through gate and continue on the bladed road for 0.7 mile to a fork. Take the left fork and continue on the main road for 0.4 mile to a very dim road on right. Take the left fork and continue on the main road for 2.8 miles to a level area between two low, brush-covered hills and a point where the jeep trail becomes very dim and difficult to follow. From here, go westerly through heavy brush for 0.05 mile to the edge of the bluff and the station mark.

The station mark is a standard disk, stamped OHAIULA 1964, set in the top of a 5-inch cement-filled cast iron sewer pipe that projects 10 inches above the surface of the ground. It is about 100 feet east of the bluff and on ground that slopes slightly to the west. There are three ridges visible to the north of the station, the nearest being about 0.1 mile. The station overlooks Mana Village to the southwest and some prominent sand dunes at Harling Sandia Beach to the west. There is an old survey target about 0.1 mile to the southwest, but is not visible from the station.

Reference Mark No. 1 is a standard disk, stamped OHAIULA No 1 1964, enclosed in a drill hole in overconing bedrock that projects about 4 inches above the surface of the ground. It is about 10 feet higher in elevation than the station mark.

Reference Mark No. 2 is a standard disk, stamped OHAIULA No 2 1964, enclosed in a drill hole in overconing bedrock that is flush with the surface of the ground. It is about 34 feet lower in elevation than the station mark.

4-wheel drive vehicle is required to reach the station.

Keys to the locked gates may be obtained from Mr. Saki Kashi, chief of the survey department of the Kauai Sugar Company in Lihue.
HORIZONTAL CONTROL DATA
by the NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: OAHUULA
EASTED BY: D.J.F. FLORIVCH
RECOVERY BY: D. WHIPP

1964
1965

STATE: Hawaii
COUNTY: Kauai

AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN:
6-1/2 miles north-northwest

HEIGHT OF TELESCOPE ABOVE STATION MARK:
4.3 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>BEARING</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
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</thead>
<tbody>
<tr>
<td>WSM 25 OPTICAL TARGET 324102</td>
<td>00 00.0</td>
<td>06 14.112</td>
<td>73 13 13</td>
</tr>
<tr>
<td>Reference Mark No. 2</td>
<td>23.940</td>
<td>7.298</td>
<td>304 57 05</td>
</tr>
<tr>
<td>Reference Mark No. 1</td>
<td>46.300</td>
<td>11.14</td>
<td>08 00.0</td>
</tr>
</tbody>
</table>

The station mark, reference marks No. 1 and No. 2 were recovered and were found to be in good condition. The distances and directions to the reference marks were checked in the field and were found to be adequate.

The station is on the west side of Hana Ridge, which is a prominent ridge on the west side of Kauai Island. It is about 6-1/2 miles north-northwest of Kauai, 5 miles west of State Highway 55 and 2-1/2 miles east of the Pacific Ocean.

To reach the station from the post office in Kauai, go west on the main street for 0.2 mile to the junction of State Highway 55. Turn right, north, on State Highway 55 for 11.65 miles to a side road left. Turn left, west, on a bladed road and Trail No. 2 for 0.15 mile to a locked gate. Pass through the gate and continue west on Trail No. 2 for 1.1 mile to a fork. Turn right, west, on a bladed road for 1.05 miles to another locked gate. Pass through the gate and continue west on bladed road for 2.8 miles to a fork. Take the left fork, west, on the bladed road for 0.7 mile to a dim fork. Take the left fork, south-west and west on the bladed road for 1.3 miles to where the road turns north. Turn right, north, staying on the bladed road for 0.1 mile to the station on the right side of the road. This is a 4-wheel drive station and keys to the locked gates may be obtained from the Kauai Sugar Company in Kauaia.

The station mark is a standard disk, stamped OAHUULA 1964, set in the center of a 5-inch cement-filled cast iron pipe that projects 7 inches above the surface of the ground. It is 23 feet northeast of the center of a bladed road and 12 feet southwest of the center of a track road.

Reference mark No. 1 is a standard disk, stamped OAHUULA NO 1 1964, cemented in a drill hole in the bedrock that projects 4 inches. It is 64 feet east of the center of a bladed road and 14 feet southeast of the center of a track road.

Reference mark No. 2 is a standard disk, stamped OAHUULA NO 2 1964, cemented in a drill hole in outcropping bedrock that is flush with the surface of the ground. It is 15-1/2 feet west of the center of a bladed road.

USCOM-NOAA-ASHVILLE
NO ORIGINAL TEXT

Opae (Kauai Island, O. B. French, 1910; F. G. Engle, 1927).—In the western uplands of Kauai, on Puu Opae. Station may be reached by traveling Knutten's old wagon road, which starts near a shack west of the Knutten estate and goes up the Pulehu Ridge, and ends at the new Puu Ka Pole macadam road about 1 mile south of Puu Ka Pole. With truck it is best to leave the truck where this road joins the public road, 1 mile south of Puu Ka Pole, hike along the old road to Opae, and afterwards continue south and meet the truck at the lower end of the road near Knutten's. Station is identical with old Government survey station “Puu Opae,” the original mark for which was said to be a 3-inch galvanized iron pipe set in cement and surrounded by a cairn of stones. In 1910 the mark at center was a small stone with cross in center set between four larger stones which project 8 inches above the surface. In 1927 a standard disk station mark was set directly over the cross in the center stone and three of the four surrounding stones, being recovered, were cemented into the station. In 1927 standard reference disks were cemented into the crosses in the rocks which formed the earlier reference marks. They are at the following distances and azimuths from the station: No. 1, 6.257 meters (20.53 feet), 78° 59'; No. 2, on opposite side of fence which crosses hill just south of station, 11.036 meters (36.21 feet), 356° 15'; No. 3, 3.451 meters (11.52 feet), 268° 55'.
HORIZONTAL CONTROL DATA
by the NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

OPAE (continued)

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

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: OPAE
ESTABLISHED BY: O.S.P. YEAR: 1910 STATE: Hawaii
RECOVERED BY: Walter R. Helm YEAR: 1961 COUNTY: Kauai

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

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

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>MEANS</th>
<th>DISTANCE</th>
<th>FEET</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORAL 1927</td>
<td>E</td>
<td>11.265</td>
<td>40.3</td>
<td>0 00 00.0</td>
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<tr>
<td>HM 3</td>
<td>S</td>
<td>36.126</td>
<td>11.013</td>
<td>281 20 51</td>
</tr>
<tr>
<td>HM 2</td>
<td>S</td>
<td>36.126</td>
<td>11.013</td>
<td>281 20 51</td>
</tr>
</tbody>
</table>

The station mark and reference mark 3 were recovered and found to be in good condition. Reference mark 2 has been damaged and the disk has been broken out and was not found, but the original cross in the rock was recovered. A new description follows:

The station is located on Puu Opea Mountain. It is 5 miles, air line, east of the west coast of Kauai Island, 4-3/4 miles, air line, north of Kekaha, 4 miles, air line, east of Mana, and 1-1/2 miles, air line, northeast of State Highway 55.

To reach the station from the junction of State Highways 50 and 55 in Kekaha, go northerly on State Highway 55 for 0.1 miles to a dirt road left. Turn left and follow the road northwesterly 3.1 miles to a reverse Y-fork. Continue straight ahead for 0.2 mile to a fork. Turn left and go about 0.5 miles to a dam on the right and end of 2-wheel drive. Turn right and go up the mountain along the dirt road for 0.3 mile to the end of the trail. Pack west or along the trail to the highest point and the station. A 10 minute pack.

The station mark, a standard disk stamped "OPAE 1927", is set in the top of a mass of concrete which is flush with the ground. The mark is surrounded by an 8-foot square concrete platform which has a 2-foot monument built on top. The monument has a 2-inch opening down through which allows for optical plum, but is small to be plumbed with a plum bob. There is a slot running under the monument.

Reference mark 2 is a chiseled cross in the top of a 3-foot boulder. Reference mark 3, a standard disk stamped "OPAE 1927", is cemented in the top of an 8-inch concrete slab secured to the top of a boulder. The boulder projects 6 inches above the ground.

Station mark and reference mark number three were recovered and found in good condition. The chiseled cross marking reference mark number two was recovered; the disk is gone and the drill hole has been filled with cement. Reference mark number one has been destroyed, probably by construction, as there are some old concrete foundations and the remains of a large wooden tower at the station. A complete description follows:

Station is located, airline, about 6 miles north-northwest of Waima village and 4 miles due east of old Mana village, on the summit of a timbered hill of 247 feet elevation known as Pau Opea.

To reach station from the junction of State Highways 50 & 55 at Kekaha, go northerly on State Highway 55 for 5.0 miles to a graded side road left. Turn left, passing a hunter checking station, and go 3.0 miles to a reverse Y. Continue ahead, downgrade, for 0.5 mile to a fork with wooden gate on right fork. Take left fork for about 80 yards to a dim jeep road on the right. (4-wheel drive vehicle is necessary). Go up this old road for 0.25 mile to end of road on hillside. Pack up along dim trail along left side of ridge line and along fence line for about 200 yards to station.

Station mark is a standard disk stamped "OPAE 1927", set in concrete. There is a "Type B" Hawaii Territory Survey signal centered over the mark, with the 4-foot-square concrete platform about 1 foot above ground and a red and white metal target extending 8 feet above the floor. Station mark is 15 feet north of a fence line.

Reference mark number two is a 4-inch, chiseled cross, with a cement-filled drill hole at its center, in the top of a 4-foot boulder that projects 3 feet above ground. It is located in an open, gray dirt area, 44 feet south of the fence line and about 1-1/2 feet lower than station. Reference mark number three is a standard disk stamped "OPAE 1927", set in the top of a 10-inch-diameter mass of concrete and small stones that is secured to the top of a 3-foot boulder that projects 1 foot above ground. It is 12 feet north of the fence line and at about the same elevation as the station.

*Note of chief of party should be inserted here. The officer who actually visited the station on the 21st of the recovery notes.

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

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

QUAD 221593 STATION 1090

LATITUDE * TO *
LONGITUDE * TO *
DIAGRAM

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: OPAE

AERIAL DISTANCE AND DIRECTION FROM NEAREST TOWN:
OAHU 1934
Reference mark No. 3
Haleiwa hill chimney 1/10-1936
5.0 11.00 ft., 3.435 m. 151 15 27
Reference mark No. 4
5 36.115 ft., 11.000 m. 247 20 53

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: OPAE

AERIAL DISTANCE AND DIRECTION FROM NEAREST TOWN:
OAHU 1934
Reference mark No. 3
Haleiwa hill chimney 1/10-1936
5.0 11.00 ft., 3.435 m. 151 15 27
Reference mark No. 4
5 36.115 ft., 11.000 m. 247 20 53

The station marks and reference marks No. 3 and 4 were recovered and found to be in good condition. The horizontal distance and direction to both reference marks were checked and coincided very closely with the 1936 measurements.

The station mark and reference mark No. 3 are on the right side of the road on a 5-foot square concrete slab. The slab is 2 feet square with a hole in the center to support a 6-foot metal target. The mark is 22 feet east-northeast of the concrete base of an old wooden tower, 15 feet north-northeast of a fence, and 5 feet south-southeast of a mass of concrete with an inscription for Pearl Harbor. It was not possible to ascertain the stamping on the disk. The reference mark No. 4 is a standard disk, stamped OPAE No. 4, 1966, cemented in a drill hole in the top of a boulder that projects about 2 feet above the surface of the ground. It is in a gray, barren area, 22 feet south-southeast of the fence and about the same elevation as the station.

A 4-wheel drive vehicle is required to reach 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.

NOTE - One of these forms must be used for every station recovered.
Pali (Kauai Island, O. B. French, 1910). In northwest Kauai, on middle of three sharp peaks at the edge of the Wainihi Pali, about 0.5 mile north of the east end of the Kauai Ridge. Station is on highest part of summit at its northern side, and is approached by trail from east end of Kauai Ridge across an open manana moor, then over the first peak. These peaks along the "pali" are all covered with an exceedingly dense and tangled mat of rhime and other underbrush. Marked by a bottle set in the ground with neck flush with the clay surface from which the rhime and roots have been cleared. Reference marks are as follows: No. 1, a % by 15 inch iron rod driven in cleared ground, with 2 inches projecting. It is 1.6 feet from station in azimuth 177°; No. 3, similar to No. 1, distant 2.6 feet azimuth 191°.

RECOVERY NOTE, TRIANGULATION STATION

MACHINE OF STATION: PAIL
ESTABLISHED BY: O.B.F. YEAR: 1910 STATE: Hawaii
RECOVERED BY: D.M. Whipp YEAR: 1955 COUNTY: Kauai
HEIGHT OF TELESCOPE ABOVE STATION MARK METERS: 0.00 HEIGHT OF LIGHT ABOVE STATION MARK METERS: 0.00
DISTANCES AND DIRECTIONS FROM GROUND AT THE STATION

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>MEASURED</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference rod No. 1</td>
<td>1.659</td>
<td>0.500</td>
<td>50° 00'</td>
</tr>
<tr>
<td>Reference rod No. 2</td>
<td>0.548</td>
<td>0.777</td>
<td>287° 00'</td>
</tr>
<tr>
<td>Reference rod No. 3</td>
<td>0.158</td>
<td>0.668</td>
<td>309° 00'</td>
</tr>
</tbody>
</table>

Station was recovered and all marks found in good condition, although the azimuths to both reference rods were found to be in error. The station was re-marked with a standard disk, and the old disk was set for an additional reference mark. A complete description follows:

Station is located in northwest Kauai, about 0.5 mile southwest of Kekaha, along Wainiha Ridge, about 1.4 mile north of its junction with Kauai Ridge, and about 500 yards north of a large, prominent, bare area in saddle, on the middle one of 3 closely-grouped points on an extremely narrow, rugged part of the ridge. The point is covered with brush and small trees.

To reach station from the Kekaha Park Headquarters, go north on main road for 0.30 mile; take gravel side road right, at sign "MONUI 0.6 MILES", and go 0.7 mile; take right fork and go 0.4 mile; take left fork at sign "MONUI 5.1 MILES" and go 0.5 mile; take left fork and go 0.06 mile; take right fork at sign "MONUI 4.7 MILES" and go 1.3 miles; take left fork at sign "ALIKAI SWAMP TRAIL 1/4" and follow old road for 0.9 mile to end of road at telephone pole. Park easerly on trail along old telephone line about 3 miles to milepost # 3. Here leave trail and go due north, clearing trail through brush, down across shallow canyon and then up onto ridge, about 1/2-mile, to station after crossing bare area. About a 2-hour hike.

Station mark is a standard disk stamped "PAIL 1910" 1966, secured to the top of a 1-inch iron pipe that is set in cement and projects 5 inches from ground. It is in the center of a small bare patch. Reference rod number one is a 3/4-inch-diameter iron rod that projects 1 inch from ground. It is at southwest end of the bare patch and at same elevation as station. Reference rod number two is a 3/4-inch-diameter iron rod that projects 2 inches from ground and is at same elevation as station. Reference rod number three is a 1/2-inch rod set in the neck projecting 3 inches from ground.

NOTE: 4-wheel-drive vehicle required for last mile of road travel.
The station is located at the Barking Sands Pacific Missile Range Facility, in a large fenced compound controlled by the Sandia Corporation, about 2.25 miles north of the control tower, 0.5 miles northeast of the beach and 0.2 mile west of the east boundary of the base.

To reach the station from the Main Gate of the Barking Sands Pacific Missile Range Facility, go north on an asphalt road for 0.25 miles to the Sandia Corporation Headquarters. Turn right and go southwest, around the corner of a small fenced area, for 0.2 mile to a "T" intersection within a larger fenced area. Turn right and go northeast on an oiled road for 0.15 mile to the station, step a low knoll on the left.

The station mark is a standard disk, stamped PEACH 1967, set in the top of a 12-inch diameter concrete post that is about 5 inches below ground level. It is 176'-1/2" feet north of a large metal building, 127'-1/2" feet northeast of the center of a dirt road and 45 feet northeast of the center of the oiled road.

Reference mark No. 1 is a standard disk, stamped PEACH No. 1 1967, set in the top of a 12-inch diameter concrete post that is flush with the surface of the ground. It is 103 feet northeast of the center of a dirt road and 20 feet northeast of the center of the oiled road.

Reference mark No. 2 is a standard disk, stamped PEACH No. 2 1967, set in the top of a 12-inch diameter concrete post that is flush with the surface of the ground. It is 133' feet north of the large metal building and 19 feet northeast of the center of the oiled road.

The station mark and reference marks were searched for, but were not recovered. It is believed that the marks were all destroyed by construction equipment.
The station is located on Barking Sands Pacific Missile Range Facility, in the Sandia Corporation compound. It is 2.0 miles north of the control tower, 0.4 mile east of the ocean shore line, and 0.3 mile northeast of Sandia northeast boundary line and 0.1 mile north of Sandia Corporation headquarters.

To reach the station from the Main Gate of Barking Sands Pacific Missile Range Facility, go northerly on asphalt road for 2.05 miles to the Sandia Corporation Headquarters. Turn right, northeast on oiled road for 0.1 mile to gate. Continue straight ahead for 50 feet and the station is on right.

The station mark is a standard disk, stamped PEAR 1967, set in the top of a 12-inch round concrete monument, flush with the ground. It is 75-1/2 feet east of a fence corner, 65-1/2 feet northeast of a gate across the oiled road, and 20 feet northeast of the centerline of the oiled road.

Reference mark number one is a standard disk, stamped PEAR NO 1 1967, set in a drill hole in a mass of concrete, flush with the ground and 2 feet lower than the station. It is 59 feet northeast of a fence corner, 6-1/2 feet northeast of centerline of the oiled road and 6-inches northwest of a 6-inch iron gate post.

Reference mark number two is a standard disk, stamped PEAR NO 2 1967, set in the top of a 12-inch round concrete monument, flush with the ground and in the same elevation as the station. It is 9 feet southeast of a fence corner and 1.3 feet northeast of a southeast and northwest fence line.
HORIZONTAL CONTROL DATA

Pele (Kauai Island, G. B. French, 1910: C. L. Garner, 1928).—In western Kauai, on the high conical peak named Puu Ka Pele, about 13 kilometers due north of Waimea. This is identical with station Puu Ka Pele of the Hawaiian Government Survey, and was marked by a 3-inch galvanized iron pipe set upright in a mass of cement, and surrounded by a cairn. In 1925 a standard triangulation disk marked "Kapele, 1908" was cemented into the pipe, and a standard disk reference mark was set in rock overcrop 13.70 meters (4.9 feet) from the station in azimuth 143° 23'. A United States Geological Survey bench mark stamped "3655" is 7.89 meters (25.9 feet) from the station in azimuth 289° 39'.

RECOVERY NOTE, TRIANGULATION STATION

Name of Station: PELE
Established by: O.B.F.
Year: 1910
State: Hawaii
Recovered by: Walter H. Helm
Year: 1961
County: Kauai

The station mark, reference mark, and a U.S. Geological Survey bench mark were recovered and found to be in good condition. A concrete platform has been built around the station mark. A large difference in distance and direction to the reference mark and bench mark were noted. A new description follows:

The station is located on the summit of Puu Ka Pele mountain. It is 2.1/2 miles, airplane, north of Waimea, 8-1/2 miles, airplane, north-northeast of Kauai, and 7-1/4 miles, airplane, east-northeast of the west coast of Kauai island at an area known as Barking Sands. It is 0.1 mile east of State Highway 55.

To reach the station from the Kokee Park Headquarters, go south on State Highway 55 for 4.55 miles to a road left at a telephone microwave station and the end of truck travel. Pack north up the hill to the highest point and the station. A 10 minute pack.

The station mark, a standard disk stamped PELE 1925, is set in a mass of concrete flush with the ground. The mark is surrounded by a 8-foot square concrete base, which has a 2-foot concrete monument built over the mark. The monument has a 6-inch opening down through it which allows for optical plumb, but is small to be plumb with a plumb bob. There is a slot running under the monument.

The reference mark is a standard disk stamped PELE 1926. It is set in a drill hole in the top of a large boulder which projects 4 inches above the ground. It is about 4 feet lower than the station mark.

Bench mark 3655 is a U.S. Geological Survey disk stamped 3655 ft. It is set in a drill hole in the top of a large boulder which projects 3 feet above the ground.

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

QUAD 221593
STATION 1054
LATITUDE 10.00
LONGITUDE 10.00
DIAGRAM

RECOVERY NOTE, TRIANGULATION STATION
NAME OF STATION: PELE
Established by: O.B.F. Year: 1910 State: Hawaii
Recoverer by: D.K. Whipp Year: 1966 County: Kauai

HEIGHT OF TELESCOPE ABOVE STATION MARK

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>ELEVATION</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMA 1210</td>
<td>NW</td>
<td>44,729</td>
<td>13,496</td>
</tr>
<tr>
<td>SPS 3655 (USGS)</td>
<td>SE</td>
<td>24,692</td>
<td>7,586</td>
</tr>
</tbody>
</table>

The station mark, reference mark, and a U.S. Geological Survey bench mark were recovered and found to be in good condition. A complete description follows:

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

Station is located about 9-1/2 miles northwest of Kekaha, on the summit of Puu Keale Mountain, on the summit of Puu Keale, a peak of about 3662 feet elevation, on the rim of Waimea Canyon and along the east side of State Highway 55. It is a telephone company's microwave relay tower on this hill.

To reach the station from the post office in Kekaha, go northwest for 0.2 miles on Kuhio Highway and follow State Highway 55 for 10.1 miles to Puu Keale. From Puu Keale, go right 0.05 miles to telephone company building and end of truck travel. Pack up steep hill about 150 yards to station.

The station mark is a standard disk stamped "PELE 1926", set in concrete 8 inches beneath a 6 x 6-foot, concrete platform, on highest point of hill, 66 feet west of the microphone relay tower. A red and white, metal signal extends from the center of the concrete platform.

A bench mark number one is a standard disk stamped "PELE 1926" cemented in a drill hole in a round, 6-foot bolt in ground with a small pipe.

A bench mark number two is a standard disk "USGS 1953", in a drill hole in a round, 6-foot bolt that projects 2 feet to the northwest side and is flush with ground on the upland side.

It is in brush, under a eucalyptus tree and 9 feet to the southwest of station mark.

USGS Bench Mark 3655 serves as reference mark number two; it is a bronze USGS disk stamped "USGS" cemented in a drill hole in a 3-foot bolt that projects 2 feet. It is on east slope of hilltop and 4.9 feet lower than station mark.

The station was recovered and found to be in good condition. All marks found to be as described in 1961.
NO ORIGINAL TEXT

Pihea (Kauai Island, O. B. French, 1910; F. G. Engle, 1927).—In northwest Kauai, on the most westerly of the three peaks called Pihea, at the northwest end of the Alakai Swamp. It is about 6 miles from the Puea Ka Pele, from which the three summits appear as one. The summit was originally timbered but in 1910 was cleared. In 1972 the trees and brush were cleared off in the directions of stations Hale and Rain. Pihea is reached by taking the trail to Kalalau Lookout; a trail was then cut eastward and then northeast along the Kaumualii Ridge. The last 2 miles are extremely bad going. Marked by a ¾ by 1½ inch iron rod, driven flush with ground. In 1972 a standard disk station mark was set directly above this iron rod in a cement mound. Reference mark No. 1, 1910, is lost. Other reference marks are as follows: No. 2, a ¾ by 1½ inch iron rod driven in the ground with 2 inches projecting, and protected by three guard stakes, is 1.574 meters (5.16 feet) from station in azimuth 310° 20' 20; No. 3, a ¾ by 1½ inch iron rod driven in the ground with 2 inches projecting, is close to a lime stump and is protected by three guard stakes. It is 1.571 meters (5.16 feet) from station, in azimuth 22° 23'.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PIHEA
ESTABLISHED BY: O.B.F.
YEAR: 1910
STATE: Hawaii
COUNTY: Kauai
HEIGHT OF TELESCOPE ABOVE STATION MARK METERS: 100
HEIGHT OF LIGHT ABOVE STATION MARK METERS: 100
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>HEADING</th>
<th>DISTANCE</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUEA 1910-1910</td>
<td>N 4° 8' 30&quot;</td>
<td>6.688</td>
<td>90° 00' 00&quot;</td>
</tr>
<tr>
<td>RM No. 2</td>
<td>S 4° 8' 30&quot;</td>
<td>2.345</td>
<td>180° 18' 42&quot;</td>
</tr>
<tr>
<td>RM No. 3</td>
<td>E 5° 0' 30&quot;</td>
<td>1.836</td>
<td>270° 10' 35&quot;</td>
</tr>
<tr>
<td>Iron rod (RM 3 1910)</td>
<td>SW 4° 3' 30&quot;</td>
<td>1.340</td>
<td>351° 18' 30&quot;</td>
</tr>
</tbody>
</table>

Station mark and old iron-rod reference points No. 2 and 3 were recovered in good condition. Rod No. 2 was removed and one of the two new reference marks established at this time was set in its place.

A complete description follows:

Station is located in the northwest part of Kauai, about 3 1/2 miles northeast of Kokee Park Headquarters, on the westerly one of three similar peaks along Kaumualii Ridge, at the southeast corner of Kalalau Valley and about ¾ mile east from the end of a jeep road.

To reach station from the Kokee Park Headquarters, go northward on paved road for 2.5 miles, take right fork at Air National Guard site and go 0.2 mile to dirt right fork at entrance to Kalalau Lookout parking area. Take this right fork and go 2.0 mile to end of road (4-wheel-drive vehicle is required). From here park eastward on trail through brush for about ¼ mile to first peak and station.

Station mark is a standard disk stamped "PIHEA 1910", set in the top of a 10-inch-diameter concrete monument flush with ground on high point. Reference mark number one is a standard disk stamped "PIHEA 1910 NO 1 1969", riveted to the top of a 1-inch iron pipe that is set in cement and projects 3 inches above ground. It is ¼ foot south of the trail and about 4 inches higher than station mark.

Reference mark number two is a standard disk stamped "PIHEA 1910 NO 2 1969", riveted to the top of a 1-inch iron pipe that is set in cement and projects 3 inches above ground and is about 3 inches lower than station mark. It is set at the point where iron-rod reference point 3 was recovered.

Iron-rod reference point 3 is a 5/8-inch iron rod projecting 3 inches above ground. It is 1 foot southwest of the trail and about 3 inches lower than station mark.

NOTE: A 50-minute pack.

*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.

NOTE - One of these lines must be used for every station recovered.
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

QUAD 221593 STATION 1096
HAWAII
LATITUDE 22° 00' TO 22° 30'
LONGITUDE 156° 30' TO 160° 00'
DIAGRAM NO 45 KAUAI

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: POLIHALE
STATE: HAWAII
YEAR: 1966
SECOND ORDER

NOTE: HEIGHT OF TELESCOPE ABOVE STATION MARK METERS, HEIGHT OF LIGHT ABOVE STATION MARK METERS.

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>Baring</th>
<th>Feet</th>
<th>Meters</th>
<th>Distance</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>CANUTE (H N) 1964</td>
<td>-</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>Reference Mark No. 1</td>
<td>-</td>
<td>23.075</td>
<td>7.005</td>
<td>121° 05' 48&quot;</td>
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<tr>
<td>Reference Mark No. 2</td>
<td>-</td>
<td>25.327</td>
<td>7.733</td>
<td>233° 37' 20&quot;</td>
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<tr>
<td>RN 1 to RN 2</td>
<td>-</td>
<td>34.436</td>
<td>10.495</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The station is located on Polihale Ridge, in the Puu Ka Pala Forest Reserve, about 9 miles north of Kealakekua, 6 miles northeast of Hanalei Bay, and 4 miles west of Kekaha Kauai State Highway 55.

To reach the station from the junction of State Highways 50 and 55 at Kealakekua, go north on State Highway 55 for 14.0 miles to a dirt road on the left. Turn left and go westerly, downhill, passing a picnic shelter on the left, for 0.1 mile to a three-way fork. Take the extreme left fork, as per sign, "TRAIL NO. 4" and go south for 0.1 mile to a fork and a house on the right. Take the right fork and continue south, parallel to fence, for 0.1 mile to a locked gate and sign, "GAME MANAGEMENT AREA". Pass through the locked gate and go westerly, downhill, along a bladed road for 4.0 miles to the station on the right.

The key to the locked gate may be obtained from the State Division of Forestry in Lihue.

The station mark is a standard disk, stamped POLIHALE 1966, set in the top of an 11-inch diameter concrete post that projects 5 inches above the surface of the ground. It is 76 feet north of the center of the bladed road and 11 feet west-southwest of a wooden witness post and sign.

Reference mark No. 1 is a standard disk, stamped POLIHALE NO 1 1966, set in the top of a 12-inch diameter concrete post that is flush with the surface of the ground. It is 101 feet north of the center of the bladed road and 23 feet northwest of a wooden witness post and sign.

Reference mark No. 2 is a standard disk, stamped POLIHALE NO 2 1966, set in the top of a 12-inch diameter concrete post that projects 8 inches above the surface of the ground. It is 68-1/2 feet north of the center of the bladed road and 15 feet east of a wooden witness post and sign.
### Adjusted Horizontal Control Data

**Name of Station:** Rain Gage  
**State:** Hawaii  
**Year:** 1967  
**Third Order**

**Position:** G-13401  
**Memo:** Observation check on this position

**Geodetic Latitude:** 22° 07' 43.88'  
**Geodetic Longitude:** 156° 43' 37.29'  
**Elevation:** 107.430'.43  
**Meters:** 00.34'.57

#### State Coordinates

<table>
<thead>
<tr>
<th>State &amp; Zone</th>
<th>Code</th>
<th>X</th>
<th>Y</th>
<th>Plane Azimuth</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>425,976.50</td>
<td>107,430.43</td>
<td>-0.34'.57</td>
</tr>
</tbody>
</table>

*Plane Azimuth has been computed by the formula reflecting the second term*

**Position determined by traverse from station WEA Vane 204**
**HORIZONTAL CONTROL DATA**

**QUAD 221553**  
**STATION 1096**  
**HAWAII**  
**LATITUDE 22° 30' TO 22° 30'**  
**LONGITUDE 156° 30' TO 160° 00'**  
**DIAGRAM 46  KAUA'I**

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** RANGE C  
**STATE:** HAWAII  
**YEAR:** 1967  
**SECOND:** ORDER

**G-13402**  
**NO OBSERVATION CHECK ON THIS POSITION**

<table>
<thead>
<tr>
<th>GEODETIC LATITUDE:</th>
<th>GEODETIC LONGITUDE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>22° 03' 17.5427'</td>
<td>159° 47' 12.2381'</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>STATE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>No. 561 561</th>
</tr>
</thead>
<tbody>
<tr>
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<td>442,655.47</td>
<td>80,555.48</td>
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</tr>
</tbody>
</table>

*Plane azimuth has been computed by the *θ* = *α* - *Ω* formula neglecting the second term.*

**POSITION DETERMINED BY TRAVERS FROM STATION HIGH**

**QF 521**
HORIZONTAL CONTROL DATA

QUAD 221593 STATION 1099
HAWAII
LATITUDE 22° 01' TO 22° 30'
LONGITUDE 159° 30' TO 160° 00'
DIAGRAM # 46
KAUAI

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: RANGE D

STATE: HAWAII
YEAR: 1967
SECOND ORDER

S-13403
NO OBSERVATION CHECK ON THIS POSITION

DESCRIPTIVE LATITUDE: 22° 02' 44.4828"
DESCRIPTIVE LONGITUDE: 159° 47' 16.4036"
ELEVATION: SCALED
D WETTING FEET

STATE & ZONE CODE X V Δ λ + Δ H
HI 4 5104 402447.34 77233.25 - 0° 06' 25"

STATE COORDINATES (1953)

POSITION DETERMINED BY TRAVERSE FROM STATION SANDS

* FLAME AZIMUTH HAS BEEN COMPUTED BY THE B URCHertz FORMULA NEGLECTING THE SECOND TERM

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEODESIC AZIMUTH (FROM STATION)</th>
<th>FLAME AZIMUTH (FROM STATION)</th>
<th>CODE</th>
</tr>
</thead>
</table>

OF 522
HORIZONTAL CONTROL DATA

NAME OF STATION: SANDIA
STATE: HAWAII
COUNTY: KAUI

CHIEF OF PARTY: D.J. Florwick
YEAR: 1964

DESCRIPTION OF TRIANGULATION STATION

NOTE:

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

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

OBJECT

<table>
<thead>
<tr>
<th>DESC.</th>
<th>MEASURING</th>
<th>DISTANCE</th>
<th>MEASUREMENTS</th>
</tr>
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<tbody>
<tr>
<td>KOLE</td>
<td>E</td>
<td>26.655</td>
<td>8.126</td>
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<tr>
<td></td>
<td>W</td>
<td>16.00</td>
<td>4.88</td>
</tr>
<tr>
<td>Sandia No 2 Launcher</td>
<td>E</td>
<td>27.655</td>
<td>8.429</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>16.00</td>
<td>4.88</td>
</tr>
<tr>
<td>Sandia No 1 Launcher</td>
<td>E</td>
<td>27.655</td>
<td>8.429</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>16.00</td>
<td>4.88</td>
</tr>
</tbody>
</table>

The station is located on the Bonham Auxiliary Landing Field, about 9.5 miles west of the town of Waimea, about 0.1 mile east of the Pacific Ocean and on the southeast side of a security area.

To reach the station from the Bonham Auxiliary Landing Field, go north on a macadam road for 1.05 miles to a gravel road. Continue north on gravel road for 0.2 mile to a locked gate. Pass through the gate and continue north on the gravel road for 0.5 mile to a security area. Continue north for 0.1 mile to a crossroad. Turn left and go west on a dirt road for 0.3 mile to the station.

The station mark, a standard disk stamped SANDIA 1964, is cemented in a drill hole in concrete on the north edge of the launcher pad. It is 115 feet east of the west security fence and 19.5 feet south-southwest of the center of the launcher pad.

Reference mark number 1, a standard disk stamped SANDIA NO 1 1964, is cemented in a drill hole in concrete on the east-southeast edge of the launcher pad. It is 140 feet east of the west security fence and 19.5 feet east-southeast of the center of the launcher pad.

Reference mark number 2, a standard disk stamped SANDIA NO 2 1964, is cemented in a drill hole in concrete on the west-northwest edge of the launcher pad. It is 110 feet east of the west security fence and 19.5 feet west-northwest of the center of the launcher pad.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: SANDIA
STATE: HAWAII
BENCH MARKS ALSO
RECOVERED BY: D.J. Florwick
YEAR: 1964
COUNTY: KAUI

AERIAL DISTANCE AND DIRECTION FROM NEAREST TOWN: At the kissing Sands Pacific Missile Range Facility.

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

The station mark and reference marks 1 and 2 were not recovered. The concrete launching pad that all 3 disks were cemented in has been destroyed, resulting in the loss of all 3 marks.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: SANDIA
STATE: HAWAII
YEAR: 1964
SECOND ORDER

SOURCE: G-13403

GEODETIC LATITUDE: 22° 07' 46.665" ELEVATION: 177.77 METERS

GEODETIC LONGITUDE: 159° 47' 04.953" ELEVATION: 12.4 FEET

STATION # 4—

| STATE & ZONE | CODE | x | y | z menu 
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 4</td>
<td>5104</td>
<td>403,985,84</td>
<td>83,285.54</td>
<td>0 06 25</td>
</tr>
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</table>

PLAN ADJUSTMENT WAS COMPUTED BY THE X - Z - Y FORMULA RELATING THE SECOND ORDER.

TO STATION OR OBJECT | GEODETIC LATITUDE | PLAN ALIGNED** (FROM MARK) | CODE |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>KOLE</td>
<td>248 23 42,0</td>
<td>248 30 07</td>
<td>5104</td>
</tr>
</tbody>
</table>

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U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICE ADMINISTRATION
COAST AND GEODETIC SURVEY