

Ka Piko o O‘ahu, Kūkaniloko: The Center of O‘ahu, Kūkaniloko

Maria Petelo and Tiffany Pahia

Faculty Adviser: Keolani Noa and Dr. Hervé Collin

Kapi‘olani Community College, Honolulu, HI

INTRODUCTION

In the Kanaka Maoli (Hawaiian) culture, Kūkaniloko is one of Hawaii's most sacred places. This location is designated as the birthplace for all Ali'i, or Chiefs, dating back to the 12th century (Hawaii Forum, 2013), and, as such, represents the Piko, or source of life, of the island of O‘ahu.

Kūkaniloko is an important sacred ground because it's where the Hawaiian Ali'i were born and because of the vast amount of mana (spiritual power) that it contained; the Ali'i wanted their children to be born here for spiritual power (Millani High School, 2001). The child was usually set to be born in the month of August because it was believed to be the time when Kūkaniloko was filled with mana. (Millani High School, 2001).



Figure 1: Piko of Kukaniloko

Kūkaniloko means to "Anchor the cry from within" (Millani High School, 2001); which the Hawaiians believed the pohaku (stones) contained the power to ease the pain of childbirth, with the help of a strict diet that the mother had to undergo.

Kūkaniloko contains many different stones, some of which were calendrical markers noting the dates of conception and predicted birthdates of chiefs. In attendance of the birth of the new Ali'i, 36 chiefs were present because paper documentation was not available; they served as witnesses to welcome the new Ali'i (Kareninhololulu, 2011). Today, there are 36 stones that guard the entrance to Kūkaniloko, although not the originals, they were placed there by the state to represent the 36 chiefs (Hawaii Forum, 2013).



Figure 2: The 36 stones lined up to Kūkaniloko.

The main pohaku or stones were in the shape of a diamond which had various ridges along the sides which were used along with the sun for time purposes. The birthing stone which is called Kūkaniloko (Sterling & Summers, 1978), has indentations in them which served as footholds for leverage (Hawaii Forum, 2013), but the mother did not actually touch the stone, because she was an Ali'i she had to be carried by four men, two in the back and two in the front, accompanied by the Kahuna (shaman) who was there to deliver the child (Sterling & Summers, 1978); gravity was expected to do most of the work.

Today, the stones are scattered about around Kūkaniloko, but are easily recognized by their bowl-like shapes and petroglyphs of circles (Hawaii Forum, 2013) that represents the piko or center, which was an important part of the pohaku because that was their reference point to everything; where it all started. The connection between Kanaka Maoli and the 'āina, or land, is ancestral and, because of this, Kūkaniloko is particularly sacred in the Hawaiian culture as it signifies the center from which life springs forth.



Figure 3: Birthstone of Kūkaniloko

PURPOSE

The purpose of this research is to confirm the location of Kūkaniloko as the piko or the center of mass of the island of O‘ahu using the scientific method.

METHOD

Grid references, Global Positioning System (GPS), and the center of mass (C.O.M.) formula were applied to validate that Hawaiians have an understanding of the scientific concept of mass and applied this knowledge in designating Kūkaniloko as the piko of O‘ahu, both literally and culturally.

First, a coordinate system was established over the island of Oahu, and the origin was set to the following GPS coordinates (21°11'57.18"N, 157°11'57.18"W). The size of the grid was 82.906 km in the x axis, and 67.355 km in the y axis as shown in Figure 4. Five different grids were used in this project. The first grid had a unit rectangle with dimensions of 20.728 by 22.452 km. The second grid had a unit rectangle of half the dimensions of the first grid, and so on. We then used the website <http://www.movable-type.co.uk/scripts/latlong.html> to calculate the x distance and the corresponding y distance to each GPS coordinate of the center of each rectangle. The elevation was measured at that point using Google Earth.



Figure 4: First grid used to calculate the C.O.M.

All data was fed into the Center of mass formula given in equations (1).

$$\bar{x} = \frac{\sum_{i=1}^n x_i m_i}{\sum_{i=1}^n m_i} \quad \bar{y} = \frac{\sum_{i=1}^n y_i m_i}{\sum_{i=1}^n m_i} \quad (1)$$

Assuming the earth's density ρ to be an invariant quantity, the mass term was substituted with $m = \rho V$, and the volume V was expressed in terms of the surface area A (of the unit rectangle of the grid) and the elevation e such as $m = \rho A e$. Hence, equation (1) was modified by canceling ρ and A from all terms as:

$$\bar{x} = \frac{\sum_{i=1}^n x_i e_i}{\sum_{i=1}^n e_i} \quad \bar{y} = \frac{\sum_{i=1}^n y_i e_i}{\sum_{i=1}^n e_i} \quad (2)$$

RESULTS

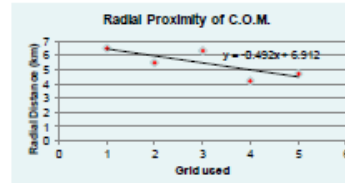
A Center of Mass value was obtained for each grid. As the grids have smaller unit rectangles, the precision of the C.O.M. was expected. Figure 5 shows the position of the C.O.M. calculated for each grid.

All C.O.M. are located within 7 km of Kūkaniloko. When the 5th calculation was done, the x coordinate was slightly further than the 4th calculation, but the y coordinate was the closest all of the grids used in this research.

Furthermore, the radial distances (in polar coordinate) of the five C.O.M. calculated in this project seem to converge towards the actual location of Kūkaniloko as shown in Graph 1.



Figure 5: C.O.M. location for each grid.



Graph 1: Radial distance of the C.O.M.

The extrapolating the x intercept of suggest that the Center of mass will match the exact location of Kūkaniloko at grid 14.

CONCLUSION AND FURTHER RESEARCH

This research suggests that selecting smaller and smaller grids seem to increase the accuracy of the center of mass calculation. Specifically, further research should include an additional 9 grids to improve significantly the outcome of this project. In addition, the density of mountain should be taken in consideration in the future, rather than assuming constant density in the center of mass calculation. Finally, further research should be conducted on the purposes of the stones of Kūkaniloko, and how they have also been used for season, calendar, and possibly navigation purposes.

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