NAVIGATING THROUGH TIME: FROM WAY FINDING TO SATELLITE

Hele po'ala i ka anu o Kīlauea

Said of a person who goes in circles and gets nowhere.

Grade 6-12 Meet at Kīlauea Visitors Center 9:30-11:30 a.m.

Painting by: Herb Kawainui Kane

Traditional Hawaiian Navigating Canoe, in search of new land .

Essential Question: How has the science of navigation changed over time?

Cartoon Analysis: Have you ever found yourself in this situation? What did you do?

Comic by: Brian Crane

Linking culture and science:

Polynesians had a unique sense of place and where they were on an island. They had a vast knowledge of their island home from the mountain to the ocean.

Polynesians used a system that is known as **wayfinding** to chart their destination. The complex task of Polynesian navigation depended on keen observation. Using this method they traveled throughout the vast Pacific Ocean without navigational instruments and found their way to Hawai'i.

Painting by: Herb Kane

Navigators used the stars, moon and sun, along with ocean currents, winds, and seabirds as signs in search of new land.

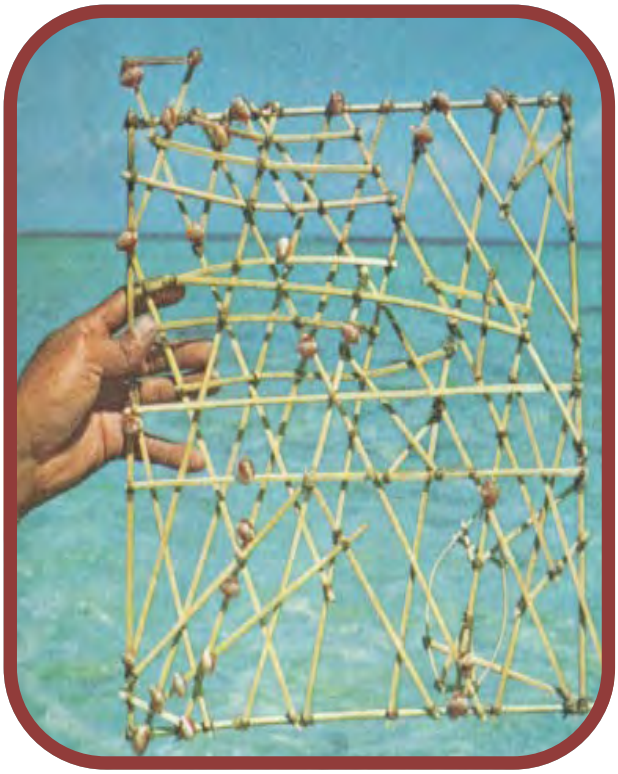


Photo Credit: Walter Meayers Edwards

A stick map from the Marshall Islands charts island locations and swell patterns, and was used as a navigating tool by early travelers

Traditional Wayfinding - By Ocean

How did they do it? For traditional Pacific island people, way finding involved navigating on the open ocean without sextant, compass, clock, radio reports, GPS or weather reports. The wayfinder depends on observations of the stars, sun, moon, ocean swells, currents, migratory birds and other signs of life for clues to locate land. Wayfinding was used for voyaging for thousands of years before the invention of European navigational instruments and is how the Polynesians migrated to Hawai'i.

In the 20th century, traditional wayfinding knowledge and techniques were in danger of being lost because of modernization and westernization of the cultures of these island peoples. The art and science of wayfinding continues in the Pacific islands because of the actions of a handful of people. A revival was led by Nainoa Thompson, the first modern-day Hawaiian to learn and use wayfinding for long-distance, open-ocean voyaging. Thompson studied wayfinding under Mau Piailug, a grandmaster navigator from the island of Satawal in Micronesia. Piailug passed away in 2010 leaving a rich legacy of navigational knowledge and skills that were nearly lost to the world. Mau navigated the first voyage of the Hōkūleʻa to Tahiti in 1976; Thompson was the wayfinder for the Hōkūleʻa voyages in 1980, 1985-87.

Photo credit: Steve Thomas

Mau Piailug - Grandmaster Navigator from Satawal in the Caroline Island Archipelago.

Photo Credit: Gregory Yamamoto

Nainoa Thompson - Master Navigator from Hawaiʻi.

A voyage undertaken using wayfinding has three components:

1. Set up a course strategy, so that the canoe can make an easy downwind sail to the destination rather than having to tack into the wind. Tacking involves sailing back and forth into the wind to make progress against the wind. It is psychologically and physically very arduous, time-consuming and something to be avoided.

2. Hold a straight course while keeping track of your position in relationship to the destination.

3. Find your destination and a safe place to come ashore.

> "*If you can see the island in your mind, you will never be lost." Mau Piailug*
>
> *"the Hokule'a never moves, it simply waits the axis of the world, as the islands rise out of the sea to greet her." Nainoa Thompson*

To learn more… http://www.pbs.org/wayfinders/index.html

Setting the stage:

Walking on the Halema'uma'u trail allows you to follow in the footsteps of some of the first Polynesians who navigated to these islands, including the slopes of the volcano. Since the March 2008 summit eruption in Halema'uma'u crater, this is the only trail that takes you to the floor of Kīlauea Caldera. As you navigate the trail you will walk beneath towering native 'Ōhi'a trees, hear the sweet sounds of 'Apapane birds, and see the ever changing landscape of Kīlauea volcano. At times non-native invasives like Himalayan ginger and *Morella faya* trees envelop you with a forest that feels very dark. Hawai'i Volcanoes National Park protects the homes of native plants, animals, and preserves native ecosystems.

Navigational tools we use today include Global Positioning Systems (GPS), which uses satellites in space to tell us where we are on the earth and how far we have travelled. A compass helps us find the angle needed to locate North, South, East, and West. Maps and photos also provide us an opportunity to work in the field using navigational tools.

Locating the Site:

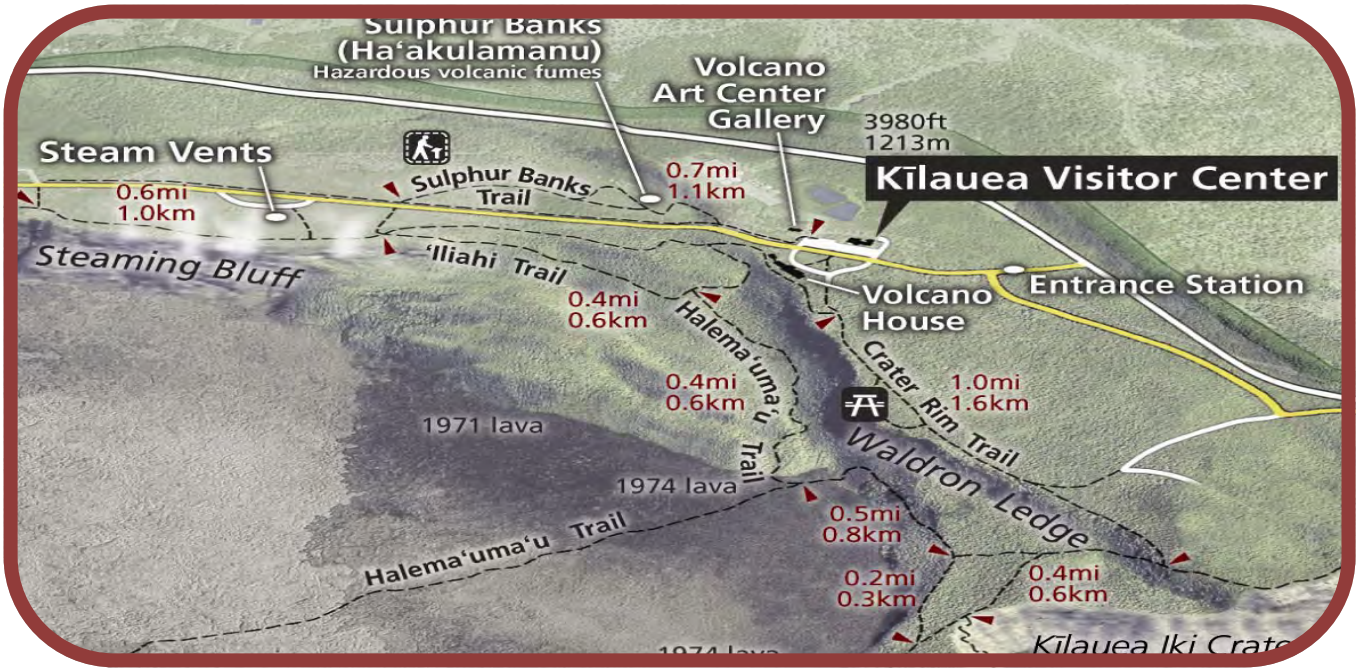


Photo credit: NPS

1. Where do you think you are on this map? _____

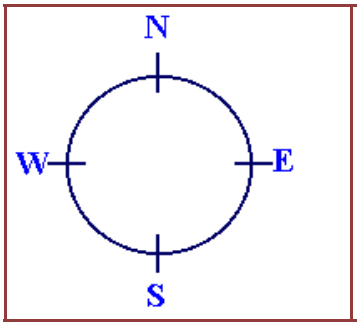
2. What elevation is the Kīlauea Visitor Center?_____ ft_____ m

3. The distance from Kīlauea Visitor Center to Ha'akulamanu is 1.1 km or_____miles.

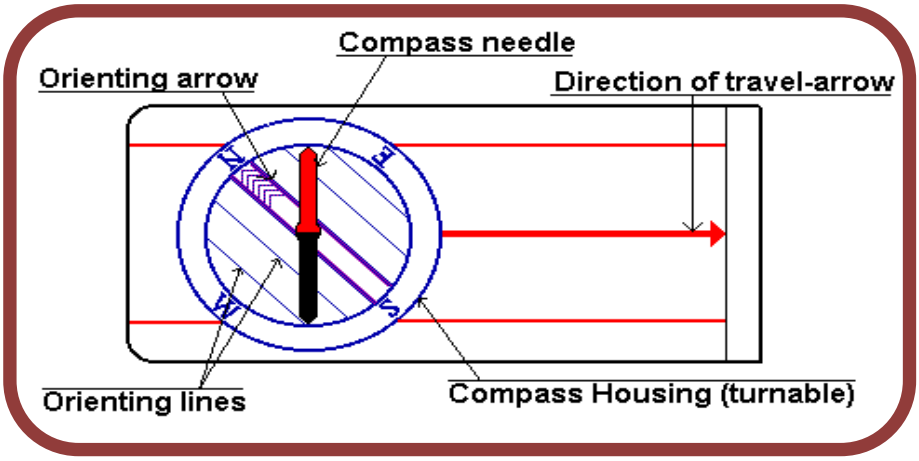
Determining the Facts:

Hawai'i Volcanoes National Park serves as a living laboratory for scientists of many fields who might use a compass and a GPS. Both are great tools to find your way, and mark points of importance that you may want to revisit later, when you can't remember exactly where that place was. By learning these skills, you broaden your knowledge of the many tools people use in the field. Someday, you may have a job which requires you to use some of these tools.

How to use a compass



The first thing we will learn are the directions North, South, East and West. Look at the figure and observe their locations.



The red and black arrows above are called compass needles.
Some compass needles are red and white.
The red arrow is always pointing towards the earth's magnetic north pole.

Photo credit: Adrian Boone

What if you want to go in a different direction?

- You will use the dial on your compass which is called the **compass housing**.
- On the edge of the compass housing you will find a scale from 0 to 360 degrees.
- This is called degrees, azimuth or bearing.
- You should also have the letters N, S, W and E for North, South, West and East on your compass.
- If you want to head in a Northwest direction, rotate the dial between N and W.
- While holding the compass, rotate the **compass housing** to the right until the number **300** is lined up with the **direction of travel – arrow.**
- Turn yourself left or right until the **compass needle** lines up with the **orienting arrow**.

If you carefully followed the directions, your compass should look like the picture above on the right. You are now facing 300 degrees NW.

How to use the GPS unit

Turn the GPS unit on. Press and hold the button with the light bulb  .

It will take a few minutes for the GPS to acquire satellite signal. You must be **outside,** in an **open space** and have **at least three satellites on the GPS.** The more satellites you have, the more accurate your location.

Press **(PAGE)** to scroll through the different screens and menu options.

At anytime you can press (**GOTO)**, scroll to **(WAYPOINT)** and press **(ENTER).** This will take you to a list of waypoints nearest you.

Press (**ENTER),** scroll down using large button in center of unit, go to first waypoint (**STOP 1)** press **(ENTER)** to navigate to this stop. As you travel to your destination, the GPS will tell you how far away you are.

Press **(PAGE)** to see different map layouts and to find a screen with an arrow that will point you in the direction you should go; continue to your next stop.

Repeat steps 1 through 4 to get to the next waypoint. The GPS will beep at each stop and your waypoint will show up on the screen as you hike the trail.

To recap the directions, press (**GOTO)** then press (**WAYPOINT)** then press (**ENTER)** to navigate to your next desired stop. Fill out the activity sheet as you go.

Photo Credit: Adrian Boone

GPS units are located at the Education Center. Unit numbers 1 to 6 will have stops numbered 1 to 7 preloaded. For Park Rangers leading this hike for school groups, contact the Education Center at 985-6019. We will be using Garmin 12 channel GPS's, large black flat screen model, and WGS 84 as our Map Datum, which is found in the Main Menu under Set Up.

Scientific Evidence: Field activity

Use your GPS, compass and photos on activity sheet to find each numbered stop on the trail.

- Each stop is programmed into the GPS.
- Groups will work with 3-5 people.

Each person will have a task; there will be a Compass person, a GPS person, a photo ID person, and a data recorder. Switch duties after each stop on the trail so everyone can practice.

Conclusion:

Congratulations, you've gotten an opportunity to expand your knowledge using wayfinding, compass and GPS for finding your destination. Who do you think require these skills for their job? Park rangers, biologists, geologists, crime scene investigators, police officers, land surveyors, resource managers are just a few jobs that require this type of background knowledge. In the world of fast changing technology, we as the next generation need to keep up to date on the resources available.

Making the ***Climate Change Connection:***

How do people voyaging from island to island or around the island have an effect on climate change? How does shipping our food to Hawaii (90%) have an effect on climate change? Cars, delivery trucks, airplanes, and cargo ships, all have a *carbon footprint.*

What can you and your 'ohana (family) do to help slow the impact of climate change and reduce your carbon footprint?

Student worksheet

You will be using compass and G.P.S. technology to complete this activity.

Photo Credit: Adrian Boone

ST 1. Name this waypoint. _____

Name one trail you found on the Crater Rim Trail sign and its distance.

_____

What compass degree is Halemaʻumaʻu trail when standing at this sign?

_____

Note your observations (see, hear, smell or feel).

_____

GPS location: N 19*25.785, W 155*15.461

ST 2. At trail sign, what direction on compass is the steam vent opposite the sign? _____ *, along Halemaʻumaʻu trail you should be walking at_____ *.

What waypoint does your GPS display? _____ .

N 19*25.785, W 155*15.499

Photo Credit: Noah Gomes

Photo Credit: Adrian Boone

ST 3. Heading down Halemaʻumaʻu trail, what is the year you see on the cement structure? _____, this compass degree going down is_____*.

What waypoint does your GPS display?

GPS location: N 19*25.781, W 155*15.537

Photo Credit: Adrian Boone

ST 6. Look at landslide to your left. Make and record observations. _____

_____

_____

_____

_____

Point the compass to 74*. What do you see?

_____

_____

What waypoint does your GPS display?

_____

Photo Credit: Adrian Boone

ST 5. Bench at the ‘Iliahi trail intersection, the trail goes in two directions. Walk on trail leading left, it will be the downhill course.

What is the compass degree? _____*.

What waypoint does your GPS display?

_____.

The trail is at what compass degree? ___

_____*,

GPS location: N19*25.798, W 155*15.571.

Photo Credit: Adrian Boone

ST 7. On the caldera floor, find compass degrees for the following:

Railing at the overlook above the floor:

_____*

Landslide:

_____*

Halema‘uma‘u Crater:

_____*

Volcano House Hotel:

_____*

Halema‘uma‘u Trail:

_____*

What waypoint does your GPS display?

_____*

Activity Worksheet: Notes & Observations

1. Think about the places you visited.

Make observations about what you felt, saw, smelled or heard. Write or draw about what impressed you the most.

2. Give a brief description for each of the following questions

Birds or animal life seen or heard:

Natural /Landscape Changes/affects:

Physical Changes/affects:

Human Changes/affects:

Stop 2. * Mark Twain

3. Give a brief description for each of the following questions

Birds or animal life seen or heard:

Natural /Landscape Changes/affects:

Physical Changes/affects:

Human Changes/ affects:

4. Give a brief description for each of the following questions

Birds or animal life seen or heard:

Natural /Landscape Changes/affects:

Physical Changes/affects:

Human Changes/ affects:

Stop 4. Trail direction is 320*

5. Give a brief description for each of the following questions

Birds or animal life seen or heard:

Natural /Landscape Changes/affects:

Physical Changes/affects:

Human Changes/ affects:

Stop 5. * Walking left angle is 150*

6. Give a brief description for each of the following questions

Birds or animal life seen or heard:

Natural /Landscape Changes/affects:

Physical Changes/affects:

Human Changes/ affects:

Stop 6. *Formation was from Earthquake in 1982. Roots are hanging from the trees, which are called aerial stress roots. Pointing compass to 74* you should see a railing on a cliff ledge.

7. Give a brief description for each of the following questions

Birds or animals life seen or heard:

Natural /Landscape Changes/affects:

Physical Changes/affects:

Human Changes/ affects:

Stop 7. *Point compass to 65*-railing overlook, 95* -rock fall, 230*-Halemaʻumaʻu, 270*-Volcano House. Angle across floor is -150*.

Below are the GPS points to be entered into GPS units, for teachers or educators to download, before they begin this program. Note Datum is WGS 84. The angle is also included in some of the stops.

St 1. N 19*25.785, W 155*15.461, Halemaʻumaʻu vent

St 2. N 19*25.785, W 155*15.499, Mark Twain

St 3. N 19*25.781, W 155*15.537 trail @ 310*?

St 4. N 19*25.789, W155*15.571 trail @ 310*

St 5 19*25.798, W 155*15.571 trail @ 160*

ST 6. 19*25.709, W 155*15.527 trail @ 240

St.7 19*25.710, W 155*15.609 trail @ 130*

St.8 N 19*25.619, W 155*15.548 trail @ 160*

St.9 N 19*25.526, W 155*15.484 trail @ 180*

St.10 N 19*25.459, W 155*15.507

St.11 N19*25.332, W 155*15.522-230*to plume-140* to trail-70* to railing, 270* to Jaggar Museum or Mauna Loa

St 12. Byron Ledge N 19*25.088

St 13. N19*25.089, W 155*15.186, trail @ 140*, 240* to plume