

# Ka Iwikuamo'o ("The Backbone")

Stars above +70° are circumpolar in Hawai'i;  
Due to the many profiles, constellations overlap



## A Collection of Curricula for the STARLAB® Polynesian Voyaging Cylinder

Including:

*Introduction to Hawaiian Astronomy* (reprinted from *Stars Over Hawai'i* by E. H. Bryan and R. A. Crowe, Peetroglyph Press, Hilo Hawai'i)



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## Introduction to Hawaiian Astronomy

### Note

The kahako, the little dash over a vowel, denotes a stressed vowel sound. The 'okina ('), or glottal stop, signals a halting of breath before a vowel.

Many centuries ago people looked up at the sky at night and thought that groups of stars formed figures. To these figures they gave names to honor characters or animals in their mythology. At first people in each region gave names of their own to the groups of stars. As years went by some of the names became well known in many lands, and were used by astronomers and astrologers to indicate exactly which stars they meant. For example, a person might say, "Aldebaran is the red star which marks the eye of the bull," or "Antares is the red star in the heart of the scorpion." The bull came to be known by its Latin name, *Taurus*; and the scorpion as *Scorpio* or *Scorpius*.

For many generations this information was handed down by word of mouth, just as the Hawaiians told their stories and passed along their knowledge. Then, about 130 C.E. (Common Era or A.D.) in Egypt, a writer of scientific information named Ptolemy collected the stories and made a catalog of star groups. Of the constellations that he listed, 48 are still recognized by modern astronomers and called by the same names. In more modern times, 40 other constellations have been added. Some of these are just "space fillers" between more prominent groups. Others are groups of stars in the Southern sky, too far south to be seen to advantage by these ancient astronomers, most of whom lived in Greece, Egypt, Persia, India and China. Some of the new constellations are named for modern mechanical objects and instruments, such as an air pump, sculptor's chisel, pair of compasses, furnace, clock, microscope and sextant. This was because the European explorers who first charted the Southern hemisphere were seafarers. Their names stand out in contrast to the names of the older, more classical constellations, that reflect a hunter-gatherer society.

Of the 88 constellations now recognized, 30 are north of the zodiac, 12 make up the zodiac (a band of constellations through which the sun and the planets appear to move across the sky), and 46 are south of the zodiac. The names of the constellations are written in Latin, long the language of science. Many of the stars have individual names, some of them given by the Arabs. Other stars are called by Greek letters and are followed by the name of the constellations. When the stars were given these letter names, what seemed to be the brightest star in the constellation was called Alpha, the next brightest Beta, and so on. If we were to say "Alpha of Taurus" in Latin we would say "Alpha Tauri," using the genitive form of the constellation name. The genitive of some names is rather different from the nominative (regular) form of the name. For example, the genitive of *Crux* (the Southern Cross) is *Crucis*.

The Hawaiians too had an extensive knowledge of the heavenly bodies and of their apparent movements and they made considerable use of this knowledge in their daily life. They watched the movement of the moon and planets with reference to the position of the fixed stars and constellations. Hawaiian astronomers were called *kilo hōkū*, *kilo* meaning stargazer or observer, and *hōkū* meaning stars; therefore, *kilo hōkū* is one who observes and studies the stars.

"Every intelligent Polynesian had a clear idea of the cardinal points, north, south, east and west, and of the points midway," writes Dr. Kenneth P. Emory in his chapter on navigation in "Ancient Hawaiian Civilization." There were names for the winds

that came from these general directions and curiously, many of these wind and direction names are similar in different Polynesian groups. For example, in Hawai'i we have the word "kona," meaning toward the southwest, and "ko'olau," toward the northeast. In the area around Samoa their equivalents are Tonga and Tokelau, after which island groups to the south and north of Samoa have been named.

The Zenith, in Hawai'i, was called "hikialoalo," and stars near the horizon were called "hikianalia." The Milky Way, which stretches across the heavens, had various names, including "Hökünohoaupuni," "Paeloahiki," "Kai'a" and "Leleaka," the first being the most common.

The Hawaiians distinguished readily between the planets, which they called "hökü'ae'a" or "hökühele," and the fixed stars, called "höküpa'a." The planets were called by different names when they were in the eastern and western sky, just as we speak of "morning star" and "evening star." If not distinguished as a particular planet, the eastern morning star was "Ho'omälonalo" (Venus or Jupiter). The evening star was "Hökükomohana." Mercury was called "Ukialali'i" (following the chief) because it was to be seen only close to the Sun; another name for it was "Ka'äwela." Venus was called "Höküao" when in the eastern morning sky, and "Hökükauhiahia" when in the western evening sky. Mars, like other red objects in the sky, was called "Hökü'ula," or more specifically "Holoholopina'au," as well as "Aukelenuiaiku." Jupiter was known as "Ka'äwela," "A'ohökü" (starlight), "lao" (dawn), and also because of its brightness, "Ikaika" (strong, powerful). Saturn's name was "Makulu" (a drop of mist). The modern Hawaiian name for Uranus is "Hele'ekela."

The Sun, known as "Lä," was not worshipped in Hawai'i as in many regions, but it was regarded with great favor because of its usefulness in giving warmth, and in helping one to tell the time of day and direction. The Sun rose ("hiki") in the direction "kukula hikina," the eastern border. The place where it set was "komohana," the western border. Facing the sunset, the right hand pointed toward "akau" (north) and the left hand to "hema" (south). An expanse or area could be indicated by using combinations of these direction words. The Hawaiian expression, "O Hawai'i ka la hiki, O Kaua'i ka la kau," indicated the expanse of the main islands of the Hawaiian chain: "Hawai'i is (in the direction of) the Sun arrived (east), Kaua'i is the Sun lodged (west)."

The Sun was the timekeeper of the day. There were names for its rising, its position half way up the eastern sky, on the meridian, turning over to go down the western sky and sinking into the west.

Various legends were told about the Sun. One of the most familiar of these is how it was snared by the demigod, Maui, to keep it from crossing the sky too quickly, in order to lengthen the day and allow time to dry the tapa made by his mother, the goddess, Hina. According to legend, Hina released the moon and stars from her calabash from which they flew up to take their places in the sky.

Another popular legend relates how Maui attempted to pull up a whole continent from beneath the ocean, but when his brothers (who were paddling the canoe) looked around and saw what he was doing, Maui's fishhook snapped and his efforts were prematurely terminated. Thus, the Hawaiian Islands were born instead. The fishhook flew up into the sky and became Ka Makau Nui o Maui, Maui's Fishhook, the constellation also known as Scorpio.

Hawaiian astronomical experts had the duty of announcing the correct time of year for preparing the soil, planting crops, harvesting, setting forth on ocean voyages, and even undertaking a battle with their enemies. From this it was but a step to call upon them to foretell or predict the outcome of all sorts of activities. This led people



to regard them as akin to astrologers and oracles. Such a Hawaiian expert was called a *kilo* (seer, prophet, or judge; one who "looks earnestly"). Basically all this went back to a knowledge of the heavenly bodies and their apparent motions, upon which the Hawaiian calendar was based. The apparent movement of the stars across the sky, from east to west, both nightly and throughout the year, was quite familiar to the Hawaiians. They may not have understood that the nightly movement was due to the rotation of the earth on its axis and the yearly movement to its revolution around the Sun, but they made good use of these movements and could measure the time of night and the calendar of events with considerable accuracy.

The moon, "*mahina*," was fundamental to the Hawaiian calendar. Each night and following day of the month had a separate name, from *Hilo*, following the first appearance of the new moon low in the western evening sky. There were thirty such names, although some months only twenty-nine would be used. That the calendar is very old in Polynesia is shown by the similarity between the names as used by the Hawaiians, Tahitians, Maori people of New Zealand, Rarotongans of the Cook Islands, Marquesans, and other Polynesian peoples. Included here are those used by the Hawaiians, Maoris, Tahitians, Rarotongans, Marquesans, and Mangarevans.

In Hawai'i, four periods of *kapu* were observed each month during eight months of the year. The four months of the *Makahiki* period had no *kapu* periods. The *Kapu* of *Kū* began on the night of *Hilo* and was lifted the morning of *Kū Kahi*. The *Kapu* of *Hua* began on the evening of *Mōhalu*, lasted two nights and a day, and was lifted on the morning of *Hua*. *Hua* means "an egg," and on the evening preceding its night and day the moon was slightly egg shaped, whereas on *Akua*, it was "distinctly round." The night and day of *Hökū* had two names: *Hökū Palemo*, if the moon set before daylight, and *Hökū Ili*, if the moon was still above the horizon when daylight came. At this point the astronomers knew whether there would be 29 or 30 days in the month. It may have been that adjustment was made at this point and the rest of the names were used each month. If the moon did not set until after sunrise the next day was called *Māhealani*; if rising was delayed until after darkness of night had set in, *Kū Lua* was used. The third *kapu* period was dedicated to *Kanaloa*, began on the evening of 'Ole Pau and ended the morning of *Kaloa Ku Kahi*. The *Kapu* of *Kane* began on the evening of *Kane* and was lifted the morning of *Lono*, when the moon rose at daybreak. *Mauli* found the moon "fainting," its rising delayed until daybreak had come. *Muku* found the moon "cut-off," when rising was delayed until the sun was so bright it could no longer be seen. In many parts of Polynesia ó Hawai'i, Samoa, Tonga, Tahiti and the Marquesas, the new year began with the first new moon following the rising of the Pleiades in the eastern sky soon after sunset. At present this is in late November; 1000 years ago it would have been the first week in November; 2000 years ago about October 20. In the South Pacific it would have been a few days later. After the annual taxes were collected in Hawai'i, there was a period of festivities called *Makahiki*. New Year now is called *Makahiki*. The names of the months of the year vary in different localities, even in the same group of islands. One Hawaiian sequence is: *Makali'i*, *Kā'elo*, *Kaulua*, *Nana*, *Welo*, *Iki'iki*, *Ka'aona*, *Hinaia'ele'ele*, *Hilina Ehu*, *Hilina Mā*, *'Ikuwā*, *Welehu*. It is not possible exactly to relate these with our calendar.

The Hawaiian astronomers were well aware that the month did not fit evenly into the year. At the end of the twelfth moon period there were ten or eleven days left over. We do not know exactly how the Hawaiian astronomers managed the details of this problem. Dr. Peter H. Buck learned on the atoll of *Manihiki*, north of the Cook Islands, that they added a thirteenth month whenever it was needed. That is exactly what the ancient Greeks did. One of the Greek astronomers, named *Meton*, worked out a cycle of 12 years with 12 months and 7 with 13 months, repeating itself after the 19 years had gone by. The 3rd, 5th, 8th, 11th, 13th, 16th and 19th had 13

months. The Hawaiian kilo hōkū doubtless discovered this "Metonic cycle" in the same way Meton had, by trying to make the month fit the year.

*In summary, we know that the ancient Hawaiians' knowledge of astronomy allowed them to make use of the position and phases of the moon in reckoning time. They distinguished between the brighter planets and the "fixed stars" and had names for those visible to the naked eye. They recognized the return of stars to the same part of the sky after the interval of a year and kept track of seasons and the beginning of the year in this way. The Hawaiians were aware of the apparent movement of the sun north and south each year and were able to maintain courses at sea by following series of stars that rose or set at the same spot ("pocket") on the horizon. Definite terms for a variety of astronomical concepts, such as zenith, horizon, major points of the compass, and groupings of stars, as well as several hundred individual stars were in common use. The kāhuna (ancient Hawai'i's masters of the arts and sciences) held their knowledge closely and shared it only with students deemed worthy. Vast amounts of knowledge have been lost over time. The fact that we do not know the modern equivalents of many Hawaiian star names is the fault of the persons who recorded the names, not the Hawaiians who pointed them out.*

## Polynesian Voyaging and Wayfinding

### Note

The kahako, the little dash over a vowel, denotes a stressed vowel sound.  
The 'okina ('), or glottal stop, signals a halting of breath before a vowel.

Sooner or later the reader of Hawaiian star lore will probably hear the story of the "sacred calabash." This is supposed to have been the sextant-like navigating instrument, which the Polynesians are said to have had when they made their long voyages to Hawai'i in great double canoes. It is described as bowl-shaped or keg-shaped, with a series of holes around the upper part of the sides, equidistant below the rim. In order to make sure that it was held level, the calabash reportedly was filled with water up to the holes. When no water spilled out any hole, it was level. The holes were bored at such a distance from the rim that, in the latitude of Hawai'i, one could look through the hole on one side and just see the Pole Star over the opposite rim.

The story goes on to describe how the navigator sailed northward until he could just see the Pole Star in this fashion; then he would sail westward until the mountain peaks of Hawai'i came into view and would make his landfall. This instrument is so simple and its use so plausible that it catches the imagination and understanding of everyone who hears about it. It really is a pity that scientists who have investigated the subject are unable to substantiate the story. The Polynesians clearly navigated by means of the stars, but what is not so clear is the role of the "sacred calabash."

A principal source of information regarding this sacred calabash comes from the late Rear Admiral Hugh Rodman, USN. When he was a young lieutenant he visited Honolulu, was entertained at the Palace, and according to his story was shown this remarkable instrument and told its story by King Kalākaua.

The King had a large calabash with a very interesting history, which he kept in the Palace and showed visitors with pride. He had it decorated with a series of gold bands on which various historic scenes were engraved. The wooden cover had a gold plate that told its history. More than half a century ago, this "sacred calabash" was placed in Bernice P. Bishop Museum. The translation of the plaque on its cover is as follows: "The wind container of La'amaomao that was in the keeping of Hauna, personal attendant of Lonoikamakahiki I. It passed on to Paka'a, a personal attendant of Keawe-nui-a-'Umi. It was placed in the royal burial cave of Ho'aiku, on the sacred cliff of Keoua, at Ka'awaloa, island of Hawai'i. Received by King Kalākaua I from Ka'apana, caretaker of Ho'aiku."

Admiral Rodman used a picture of this calabash to illustrate his story, so it is unlikely that he had any other calabash in mind. The question is, could this have been used as a navigating instrument and, if not, what was its use? This calabash has a series of holes, in threes, around the rim. Their distance from the edge is such that sighting through even the lowest of the three and over the opposite rim would give an angle of about 11 degrees. The calabash measures more than 33 inches high and a foot in diameter. Filled with water up to the level of the holes, it would weigh more than 100 pounds. With such a weight it would be very difficult to hold level at arms length in a bobbing canoe, let alone to use as a sextant. Could the "sacred calabash" have been a watertight traveling trunk, a container for such things as featherwork,

*fine tapa, ornaments and other possessions on a sea voyage or in the home? Most of them were made of large gourds covered with a plaited or twined reinforcement of fiber, the aerial rootlets of the 'ie'ie (Freycinetia arborea). A number of them are preserved in Bishop Museum and others are known. The series of holes was used in tying on the gourd or wooden cover, but in no case do the holes give an angle as large as 20 degrees, the latitude of Hawai'i.*

*The story of the calabash has been intertwined with that of the Hawaiian gourd compass, first related to Theodore Kelsey by David Malo Kupihea (see "Nä Inoa Hökü," 1975, by Rubellite K. Johnson and John K. Mahelona). A navigation gourd compass might be from about 1.5 to 3 feet in diameter, and at least 4 to 6 inches deep. It might be made of any suitable wood such as kou or milo. There were two sight holes; one was aligned with Polaris. At intervals of 40-45 degrees at the rim of the gourd were double hitches called pu'umana. Across the top of the gourd a net was placed; special terms were used to designate each mesh square (maka) or pu'umana knot ('alihi) at the circumference. Stars were reflected in the water and seen through the 36 mesh squares; as the voyage proceeded, the stars were tracked across the net. The star in the east was called the H k iwa, or frigate bird. Each of the nine principal guide stars was represented by one of the pu'umana knots around the edge of the gourd rim. In a single canoe, the gourd might be hung up on the mast, or fastened to the covering piece over the bow, by placing the net with meshes over it and tacking down the extending cords around it. The man in the bow would then be the kilo, or observer. According to Kupihea and Kelsey, navigation gourds (smaller versions of the calabash) were used on local trips to other islands, although this is difficult to substantiate.*

*If they did not use a calabash-sextant, how then did the Polynesians navigators observe the stars in navigating their double canoes across the Pacific? Observe the stars they did, and they very likely needed no mechanical sextant to do so. In addition, they had extensive knowledge of the winds, ocean swells and currents, the flight of birds and the subtle arrangement of clouds over islands. They had good judgment in estimating angles. Crossing the equator, we can watch the pole star come into view above the horizon, and climb slowly up the sky as we proceed northward. We would have no trouble judging the north latitude within one degree. A skilled Polynesian navigator certainly could have done better. Long before his canoe had come within sixty miles of an island, the flight of birds would have told him of the presence and direction of land.*

*Ancient Polynesian methods of navigation by means of stars, winds, swells, currents, cloud tints and the flight of birds, have been rediscovered in Hawai'i through the people of the Tuamotu Archipelago. They still use these methods, which were almost forgotten in most parts of Polynesia. Direction is kept at night by steering toward one after another of a definite series of stars, when these guiding stars are near the horizon. If heading in a westerly direction, these stars are those that seem to sink into the same "pocket," or "house," of the sky. Heading in an easterly direction, the guiding stars all rise out of the same "house." A voyage between distant islands generally is undertaken at a certain time of year, when winds, currents and conditions at sea are likely to be favorable. The list of guiding stars for each course and season was a definite part of the sailing directions. A favorite time to set out for islands to the south was autumn, and Sirius was one of the guiding stars at that time.*

*Much of the star lore connected with voyages to Hawai'i has been lost. Even the modern equivalents of Hawaiian star names are gone, because the persons who recorded these names, which their Hawaiian informants recited, did not themselves know the English or Latin names of the stars and constellations. More than 200 names of heavenly bodies known to the Hawaiians are listed, but only a small part of them can be identified today. A principal reference for such information is "Nä Inoa*



*Hökü" (1975), by Rubellite K. Johnson and John K. Mahelona.*

*Early Hawaiian tradition is full of accounts of famous navigators. Some of these are noted by Bruce Cartwright in "Some Ali'i of the Migratory period," (Bishop Museum Occasional Papers, 10 (7), 1933); others in the folklore were gathered by Judge Abraham Fornander and published in Bishop Museum Memoirs, volumes 4 to 6, and his "Polynesian Race," volume 1, London, 1878.*

*There is the story of Pö'ao, one of the pioneer settlers of Puna, Hawai'i. He had with him an astronomer and navigator as well as a sailing master. Finding the Hawaiian Islands a good place to live, he returned to Kahiki to get a chief who could rule over the little band of settlers in that part of Hawai'i. His return voyage from the Society Islands with the chief Pili may have helped to establish the system of sailing directions for this route.*

*Another great navigator, Kaulu, the son of Kalana, navigated from Hawai'i to the southern islands and brought back a famous priest, navigator and astronomer named Luhaukapawa. Still another famous navigator and astronomer of Hawaiian tradition was Kamahualele. He accompanied Mö'ikeha, a chief of O'ahu, on his voyage from Waipi'o, Hawai'i, to the Society Islands and back to Kaua'i. He then returned to Kahiki with Kila, youngest son of Mö'ikeha and again returned safely to Kaua'i.*

*These were hardy men, who could stand long periods of exertion on limited supplies of food and water. They understood the sea and its currents and the winds. They were guided by the position of the Sun by day and of the stars at night. They made landfalls by watching the flight of birds. They believed that they were never separated from the gods and demi-gods of the ocean depths, and the materials of life. The seafaring Polynesians were the greatest ocean explorers of their time and with the use of the large double-hulled canoes (wa'a kaulua), they arrived from Nuku Hiva (Marquesas) and Tahiti. The canoe captain, or ho'okele, likely did not need a compass, chart or sextant to make the voyage.*

*By the time Europeans arrived in Hawai'i in the 18th century, voyaging between Hawai'i and the rest of Polynesia had ceased for more than 400 years. The reason for decline of voyaging is not known, but archaeological evidence suggests a dramatic expansion of population and food production in the Hawaiian Islands. Perhaps ties to families and gods in Polynesia weakened over time as the society in Hawai'i flourished.*

*The Polynesian Voyaging Society was established in the early 1970s to rediscover the ancient art and science of Hawaiian navigation. The wa'a Höküle'a was built between 1973-1975, and made its first historic voyage from Hawai'i to Tahiti, guided without instruments by traditional Micronesian navigator Mau Piailug. In 1980, Hawaiian Nainoa Thompson, a student of Mau's, successfully navigated Höküle'a to Tahiti and back to Hawai'i. In 1985-87, Höküle'a voyaged to Aotearoa (New Zealand) and back via Tahiti, the Cook Islands, Tonga, Samoa and Tuamotu; in 1992 she went to Tahiti and the Cook Islands, and in 1995, to Nuku Hiva (Marquesas). In 1999-2000, 25 years of voyaging achievement culminated with another historic voyage to Rapa Nui (Easter Island), the most isolated island in Polynesia, as well as to the Marquesas and Pitcairn Island.*

*The traditional navigation system used by Mau Piailug designates 32 distinct houses around the horizon at unequal angular intervals. A star rises, like the Sun, in a particular house on the eastern horizon, travels across the sky, and sets in a corresponding house on the western horizon. On the Hawaiian star compass, designed by Nainoa Thompson, the 32 houses are at equally spaced angular intervals of  $11\frac{1}{4}^\circ$ . The house in which a star rises has the same name as the house in which it sets. The house that a star sets in is at the same angular distance and*

in the same direction from west as the house in which it rose in the east. Thus, the recognition of a rising or setting star and the knowledge of the house in which it rises and sets gives the observer a directional point of orientation. The rising points of the 21 brightest stars (canoe-guiding stars, or Höküho'okelewa'a) on the star compass are for stars rising at the Equator. As the observer moves away from the Equator, rising and setting points shift north for stars rising north of east, and south for stars rising south of east. At the north and south poles, of course, stars travel in circles at fixed altitudes around the sky, without rising or setting. The Moon (mahina) rises about 48 minutes later each night at a different position on the eastern horizon from the night before. Its rising point moves back and forth between ENE ('Aina Ko'olau) and ESE ('Aina Malanai) during its 29.5 day cycle. It sets between WNW ('Aina Ho'olua) and WSW ('Aina Kona).

Nainoa Thompson used three major star groups to navigate; these three groups are Ke Ka o Makali'i ("The Canoe-Bailer of Makali'i"), Ka Iwikuamo'o ("The Backbone"), and Manaiakalani ("The Chief's Fishline"). A fourth star group has now been added, Ka Lupe o Kawelo ("The Kite of Kawelo"). Ke Ka o Makali'i is formed by five stars curving across the sky from north to south in the shape of a bailer; these five stars are Capella (Höküle'i), Castor and Pollux (Nä Mahoe), Procyon (Puana), and Sirius (A'ä). Ka Iwikuamo'o runs from Polaris at the north celestial pole to the Southern Cross near the south celestial pole and is seen as vertebrae along a backbone. The star line includes Polaris (Höküpa'a), Kochab (Holopuni), The Big Dipper (Nä Hiku), Arcturus (Höküle'a), Spica (Hikianalia), Corvus (Me'e), the Southern Cross (Hänaiakamälama), and Alpha and Beta Centauri (Nä Kuhikuhi, or "The Pointers"). Manaiakalani goes from Cassiopeia ('Iwa Keli'i) in the north to Scorpius (Ka Makau Nui o Maui) in the south, and is dominated by the Navigator's Triangle, comprised of Deneb (Pira'etea), Vega (Keoe), and Altair (Humu). Scorpius (also called "Maui's Fishhook") is on the opposite side of the sky from Orion (Nä Kao, referring to the belt of three stars, or Ka Heihei o na Keiki, referring to the whole star group). The northern part of Ka Lupe o Kawelo is made up of Cassiopeia ('Iwa Keli'i) and the Great Square of Pegasus (Ka Lupe). The southern part is made up of the stars Fomalhaut, Alnair, Diphia, Ankaa, and Achernar.

In 1993, Na Kalai Wa'a Moku o Hawai'i was established with the creation of Mauloa, a traditionally carved coastal-outrigger sailing canoe. This would plant the seed for the creation of a second wa'a, the Makali'i. The purpose of Makali'i was to provide communities on the islands of Hawai'i with educational experiences. The canoe is a tool by which communities may be exposed to ancient Hawaiian seafaring traditions and protocols. Makali'i was completed in early 1995 and made her inaugural roundtrip voyage to Tahiti and the Marquesas, with ho'okele Clay Bertlemann and Chad Paishon. In Tahiti, the Makali'i was united with the Höküle'a as well as other voyaging canoes from Aotearoa, Rarotonga and Tahiti; this reunion with descendants of the ancestors of the Hawaiian people was of enormous spiritual significance, and connected the Polynesian and Hawaiian cultures.

## Hawaiian Constellations and Star Lines

These names are organized by star lines, generally from north to south. Some of the names are traditional; others have been assigned by the Polynesian Voyaging Society (indicated by PVS) The experienced navigator would have a firm grasp of all the information below, especially the names, houses and declinations.

Right ascension is measured east along the celestial equator from the vernal equinox in hours (h) and minutes (m) of time; declination is measured north (+) or south (-) from the celestial equator in angular degrees (°) and arc-minutes (′), and  $1^\circ = 60'$ .

### 1. Ke Kä o Makali'i (name of first star line, near 6 hours right ascension)

"The (canoe) bailer of Makali'i". This is a north-south curve of bright stars, formed by the Pleiades, Aldebaran, Capella, Castor, Pollux, Procyon, Sirius, and Canopus, with Orion inside the curve. Makali'i was a navigator for the chief Hawai'iloa, and was according to tradition the discoverer and first settler of Hawai'i. The Big Island voyaging canoe Makali'i is named after him (PVS).

#### Makali'i (Pleiades)

"Little eyes", or "Eyes of the chief". Makali'i was the navigator and steersman for the voyaging chief Hawai'iloa. The rising of this cluster of stars in the east at sunset (now mid-November) marks the beginning of the celebration of Makahiki. Makali'i rises in 'Aina (land) house, Ko'olau (Northeast), with a declination of  $+24^\circ$ .

#### Kapuahi (Aldebaran)

"Sacred fire". This is an appropriate name for this red giant star that marks the eye of Taurus, the Bull. It is also called Hökü'ula ("red star"). Kapuahi rises in Lä (sun) house, Ko'olau (Northeast), with a declination of  $+16^\circ$ .

#### Hökülei (Capella)

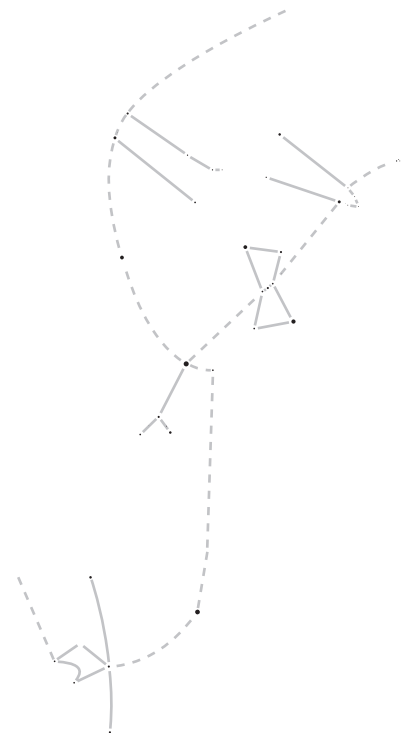
"Wreath, or lei of stars". This yellow giant star is similar to the Sun in temperature and color. It is the brightest star in the constellation of Auriga, which resembles a lei (wreath) of five stars. Hökülei is also the name for the constellation. Hökülei rises in Manu (bird) house, Ko'olau (Northeast), with a declination of  $+46^\circ$ .

#### Nä Mähoe (Gemini, the Twins)

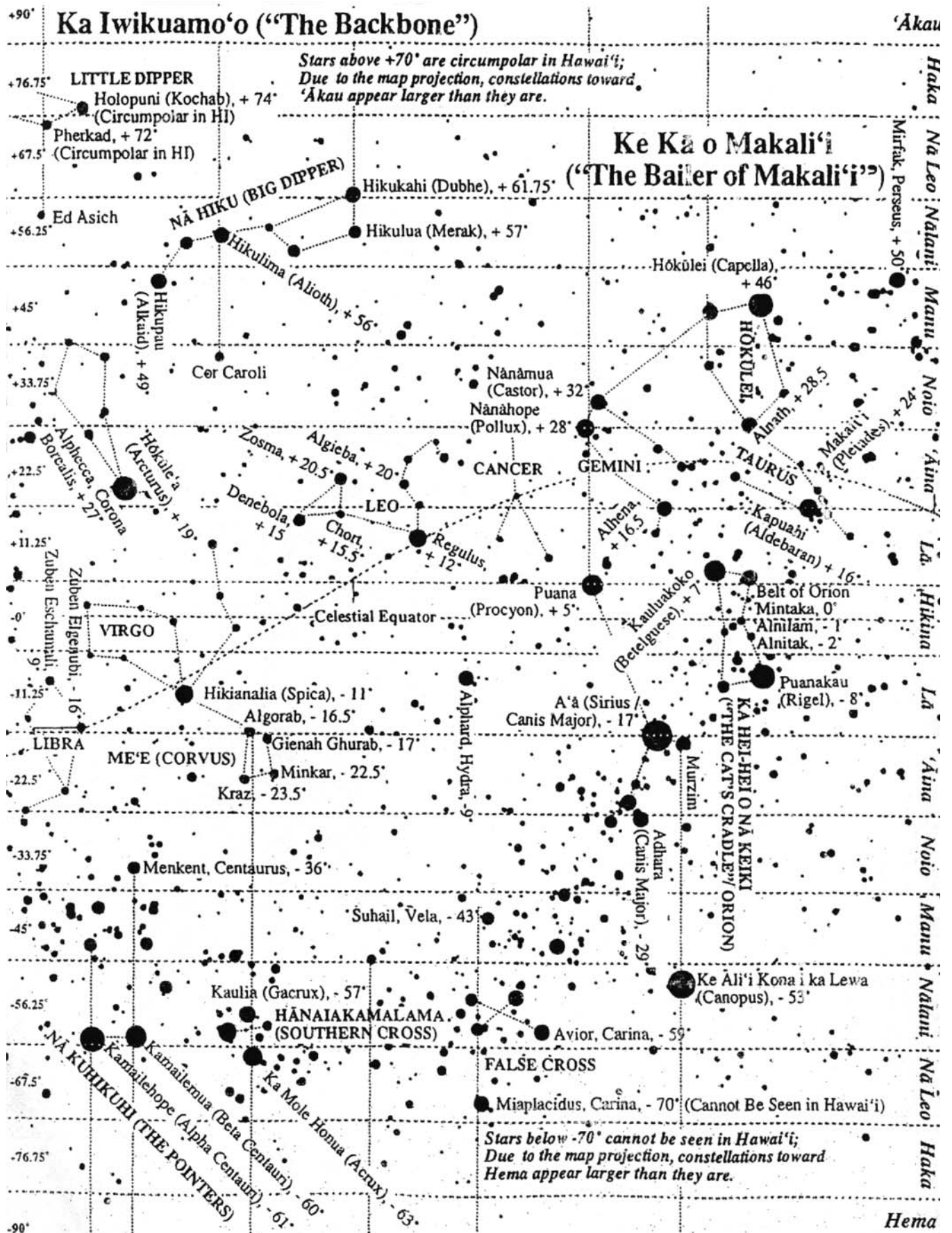
"The twins". In Hawaiian, the twins are Nänämua (Castor), "the one who looks forward", and Nänähope (Pollux), "the one who looks behind". Castor, a whitish star of declination  $+32^\circ$  (which is actually a sextuple system), is the one closest in the sky to Capella in Auriga, and Pollux, a red giant star of declination  $+28^\circ$ , is the one closest to Procyon in Canis Minor. Nä Mähoe rise in Noio (Hawaiian tern) house, Ko'olau (Northeast).

#### Puana (Procyon)

"Blossom". This yellowish star in the constellation Canis Minor is called Puanagahori ("False Puanga") in Maori, to distinguish it from the blue supergiant star Puanga-rua ("Blossom cluster") in the constellation Orion, which Hawaiians call







Puanakau (Rigel), "the blossom suspended above". Puana rises in Hikina (East) house, with a declination of +5°.

#### A'ä (Sirius)

"Fiery, or burning brightly". A'ä is also the name for a seabird known as the booby. This blue-white star is the brightest in the entire sky, and is in the constellation of Canis Major. It is also the zenith star of Tahiti. A'ä rises midway between Lä (sun) and 'Aina (land) houses, Malanai (Southeast), with a declination of -17°.

#### Ke ali'i o kona i ka lewa (Canopus)

"The chief of the southern heavens". This yellow supergiant star is second brightest in the sky. Ke ali'i o kona i ka lewa rises in Nälani (the high chief) house, Malanai (Southeast), with a declination of -53°.

#### Ka Heihei o Nä Keiki (Orion)

"The string figure of the children". The constellation was named for its resemblance to a cat's cradle, or string figure (heihei) made by children. The string figure which the configuration most closely resembles goes by the name of hökü (star), ku'uku'u (spider), or kohe'ekemu (embrace me), a continuation of the figure po (night), which represents a starry night. The figure (traced out by the rectangle of Betelgeuse, Bellatrix, Rigel and Saiph, with Orion's belt in the middle) travels along the celestial equator, which was called Ke Alanui o Ke Ku'uku'u ("The Roadway of the Spider"). Mintaka, one of the three stars in the belt of Orion (Nä Kao) rises almost due east (Hikina) and sets almost due west (Komohana), since it is on the celestial equator (with a declination 0° 18').

#### Kauluakoko (Betelgeuse)

"Brilliant red star". This red supergiant star marks the armpit or shoulder of the hunter Orion. Koko means blood or rainbow-hued. Kauluakoko rises in Lä (sun) house, Ko'olau (Northeast), with a declination of +7°.

#### Puanakau (Rigel)

"Blossom suspended above". This blue supergiant star marks the knee of the hunter Orion. The star is called Puanaga-rua ("Blossom cluster") in Maori, to distinguish it from the yellowish star Puanga-hori ("False Puanga") in the constellation Canis Minor, which Hawaiians call Puana (Procyon), "blossom". Puanakau rises in Lä (sun) house, Malanai (Southeast), with a declination of -8°.

#### Pu'uhonua (Saiph)

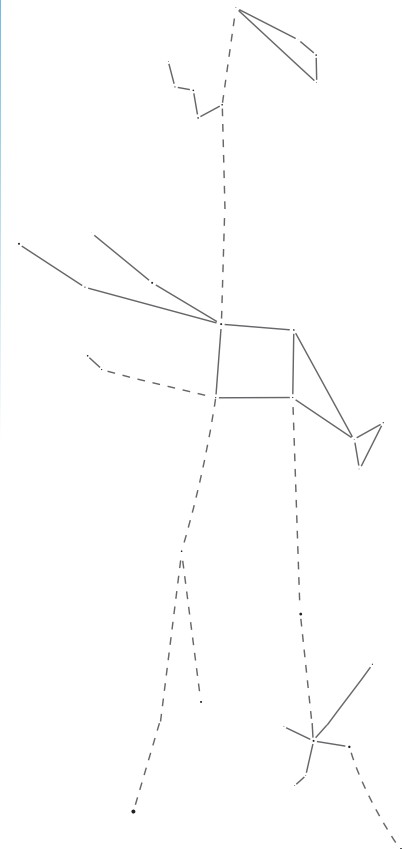
"Place of refuge". Pu'uhonua rises in Lä (sun) house, Malanai (Southeast), with a declination of -10°.

## 2. Ka Iwikuamo'o (name of second star line, near 12 hours right ascension)

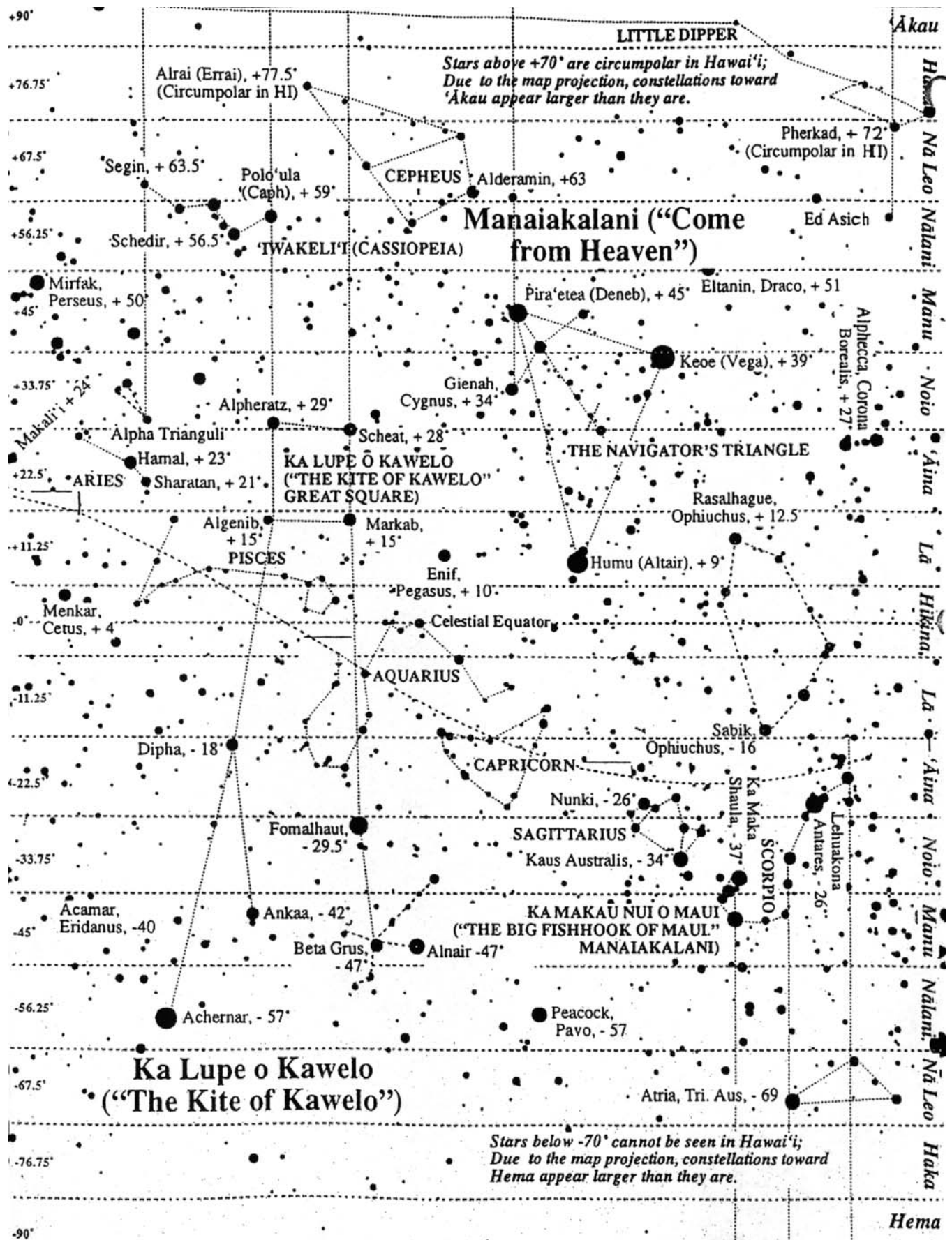
"The backbone". This starline runs from Höküpa'a (Polaris) at the North Celestial Pole to Hänaiakamälama (Southern Cross) near the South Celestial Pole, passing through Ursa Minor (Little Dipper), Ursa Major (Big Dipper), Arcturus, Spica, and Corvus, along the way. The stars in this line are seen as vertebrae along a backbone, a metaphor for a genealogical line, with each vertebra representing a generation.

#### Höküpa'a (Polaris)

"Fixed star". This star appears "stationary" at the North Celestial Pole with other stars circling around it. Actually, it is inscribing a small circle, 1.8°, around the pole. Because of precession, the wobbling of the Earth's axis like a spinning top,







Höküpa'a is not actually fixed permanently. A circle of precession is completed in 26,000 years; in 14,000 C.E., the North Celestial Pole will be pointing to near the opposite side of the circle of precession, between Deneb and Vega. Thus, in about 12,000 years, Höküpa'a will be circumpolar! Höküpa'a rises in 'Akau (North) house, with a declination of +89°.

#### Holopuni (Kochab)

"To sail or travel around". This star in Ursa Minor (The Little Dipper) circles around Höküpa'a in the Hawaiian sky (PVS). Holopuni rises in Haka (empty) house, Ko'olau (Northeast), with a declination of +74°, circumpolar in Hawai'i.

#### Hökümau (Pherkad)

"Star of Mau, the Navigator". Hökümau rises in Haka (empty) house, Ko'olau (Northeast), with a declination of +72°, circumpolar in Hawai'i.

#### Nä Hiku (The Big Dipper)

"The Seven". The stars of Nä Hiku are designated by numbers: Hikukähi (Dubhe, declination +62°), Hikulua (Merak, declination +56°), Hikukolu (Phecda, declination +54°), Hikuhä (Megrez, declination +57°), Hikulima (Alioth, declination +56°), Hikuono (Mizar, declination +55°), and Hikupau (Alkaid, declination +49°). Merak and Dubhe are the Pointers to Höküpa'a. The angular separation between the Pointers is extended five times along the line between them towards Höküpa'a. Hikukähi rises between Nä Leo (the voices) and Nälani (high chiefess) houses, Ko'olau (Northeast). Hikupau rises in Manu (bird) house, Ko'olau (Northeast). The other five stars rise in Nälani (high chiefess) house, Ko'olau (Northeast).

#### Höküle'a (Arcturus)

"Star of Gladness". This orange-red giant star is Hawai'i's zenith star. In the Ka Iwikuamo'o starline, follow, or extrapolate, the arc of the Big Dipper's handle to locate Arcturus in the constellation of Boötes. The voyaging canoe Höküle'a is named after this star (PVS). Höküle'a rises in 'Aina (land) house, Ko'olau (Northeast), with a declination of +19°.

#### Hikianalia (Spica)

Unrecorded meaning. Hiki might mean "star"; Hikianalia might mean "star near the horizon". This blue-white star is south of Höküle'a. In the Ka Iwikuamo'o starline, follow the arc of the Big Dipper's handle to Arcturus, and continue in that direction to Spica. Hikianalia rises in Lä (sun) house, Malanai (Southeast), with a declination of -11°.

#### Höküpä (Leo)

"Fence star".

#### Regulus (in Leo)

Hawaiian name unknown. Regulus rises in Lä (sun) house, Malanai (Southeast), with a declination of +12°.

#### Alphard (in Hydra)

Hawaiian name unknown. Alphard rises in Lä (sun) house, Malanai (Southeast) with a declination of -9°.

#### Me'e (Corvus)

"Voice of Joy", or "Mouth of the Chanter". Me'e is the Marquesan name for the Polynesian name Mere, Meremere, or Melemele. The Hawaiian form of Me'e is Mele, which means "song" or "chant". Me'e rises in 'Aina (land) house, Malanai (Southeast), between declinations of -16.5° and -23.5°.

### Hänaiakamälama (Southern Cross, or Crux)

"Cared for by the moon". When the long axis of the Southern Cross (from Gacrux to Acrux) is vertical, the cross is directly south. In the Ka Iwikuamo'o starline, the open end of the "Mouth of the Chanter" leads to the Southern Cross.

### Kaulia (Gacrux)

"Suspended", or "hanging". This red giant star is at the top of the Southern Cross; it is sometimes called the "chief of the month of Iki'iki (May)" because it appears in that month. Kaulia rises in Nälani (high chiefess) house, Malanai (Southeast), with a declination of  $-57^\circ$ .

### Ka Mole Honua (Acrux)

"The bottom, or foundation of the Earth". This blue star is at the bottom of the Southern Cross. Ka Mole Honua is the ancestral root, or foundation of Ka Iwikuamo'o, which metaphorically refers to a genealogical line. Ka Mole Honua rises in Nä Leo (the voices) house, Malanai (Southeast), with a declination of  $-63^\circ$ .

### Nä Kuhikuhi

"The pointers". In Hawaiian, the pointers are Kamailemua (Beta Centauri), "the first maile vine", and Kamailehope (Alpha Centauri), "the last maile vine". Beta Centauri is the one closest to Crux, and therefore it rises first. Alpha Centauri (which is actually a triple) is the closest star system to the Sun at a distance of 4.3 light years (we see the star as it was 4.3 years ago). Nä Kuhikuhi rise in Nälani (high chiefess) house, Malanai (Southeast), with declinations of  $-61^\circ$  (Kamailehope) and  $-60^\circ$  (Kamailemua).

## 3. Manaiakalani (name of third star line, near 18 hours right ascension)

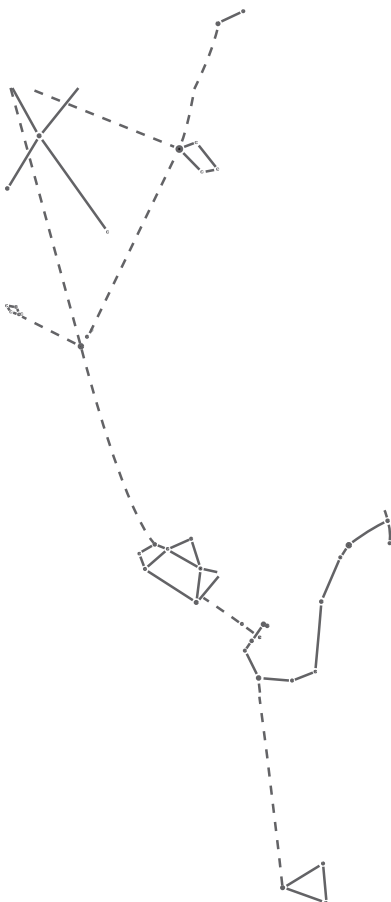
"Come from Heaven", or "The Chief's Fishline". This is a large triangle formed by the three bright stars Deneb, Vega, and Altair (representing the corners of the Polynesian, or Navigator's Triangle), leading to Sagittarius and Scorpius in the southern sky. Manaiakalani is the name for the fishing hook of the demi-god Maui; he used this hook to drag up new islands from the bottom of the ocean. Manaiakalani is also the name given to the fishhook of the Hawaiian fishing god Kū'ula and his son 'Ai'ai, after the constellation known in Greek mythology as Scorpius.

### Pira'etea (Deneb)

"White sea swallow". This brilliant supergiant has no recorded Hawaiian name. According to Tahitian tradition, the Pira'e was the pet bird of Ra'itupua (Sky-builder). Pira'etea represents the corner of the Navigator's Triangle corresponding to Hawai'i, and for that reason, is also referred to as Hawa'iki. Pira'etea rises in Manu (bird) house, Ko'olau (Northeast), with a declination of  $+45^\circ$ .

### Keoe (Vega)

Unrecorded meaning. According to Maud W. Makemson ("The Morning Star Rises", 1941), Keoe is a Hawaiian name that applied to both Vega and the constellation Lyra (a group of four stars forming a diamond). Keoe represents the corner of the Navigator's Triangle corresponding to Rapa Nui (Easter Island). Keoe rises in Noio (Hawaiian tern) house, Ko'olau (Northeast), with a declination of  $+39^\circ$ .



### Humu (Altair)

"A Navigator and his two sons". This star and the two on either side of it were named Humumä for the navigator Humu and his two sons. According to Kupahu, Humumä were guiding stars to Kaua'i for any canoes sailing from O'ahu. On one voyage to Kaua'i, Humu's two sons were in the first canoe, and the older son, familiar with Humumä, told the steersman which direction to sail in (Humumä would set south of Kaua'i, as seen from O'ahu). The steersman became angry, and threw Humu's two sons overboard; they swam toward Humumä and were rescued by their father, who navigated in the last canoe with the King. Humu and his two sons thus reached Kaua'i, while the other canoes became lost at sea. Humu represents the corner of the Navigator's Triangle corresponding to Aotearoa (New Zealand). Humu rises in Lä (sun) house, Ko'olau (Northeast), with a declination of +9°.

### Ka Makau Nui o Maui (Scorpius)

"The Big Fishhook of Maui". This constellation is also called Manaiakalani. A popular legend relates how Maui attempted to pull up a whole continent from beneath the ocean, but when his brothers (who were paddling the canoe) looked around and saw what he was doing, Maui's fishhook snapped and his efforts were prematurely terminated. Thus, the Hawaiian Islands were born instead. The fishhook flew up into the sky and became Ka Makau Nui o Maui, the constellation also known as Scorpius.

### Lehuakona (Antares)

"Southern lehua blossom". This red supergiant star is part of the shank of Ka Makau Nui o Maui, or is the heart of the scorpion. Lehua suggests the color red, or it could be the Hawaiian form of Rehua, the Maori name for the star, that represented a bird with two wings, one of them broken. Lehuakona rises in 'Aina (land) house, Malanai (Southeast), with a declination of -26°.

### Ka Maka (Shaula)

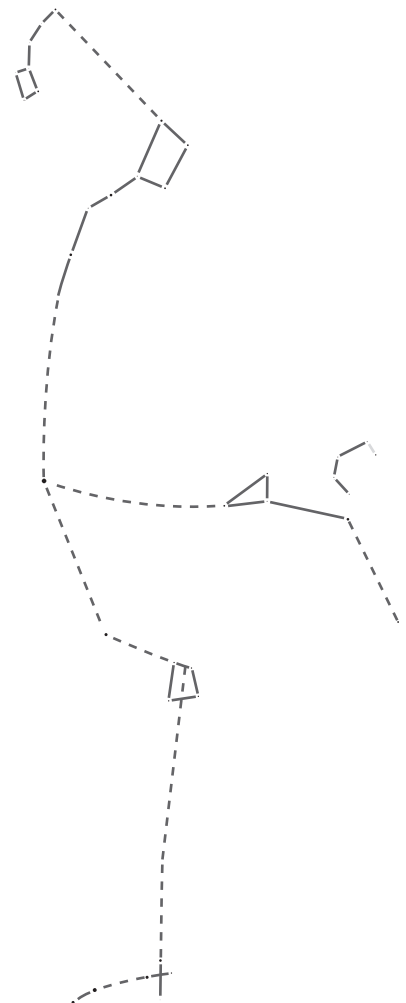
"The point of the fishhook". It is also the stinger of the scorpion. Ka Maka rises in Noio (Hawaiian tern) house, Malanai (Southeast), with a declination of -37°.

### Pimao (Sagittarius)

"The fish". This is the star group known as the "Teapot" in the constellation of Sagittarius, the Archer. Pimao rises in 'Aina (land) and Noio (Hawaiian tern) houses, Malanai (Southeast), between declinations of -34° and -26°.

## 4. Ka Lupe o Kawelo (name of fourth star line, near 0 hours right ascension)

"The Kite of Kawelo", otherwise known as The Great Square of Pegasus. An imaginary line can be extended from Polaris through Alrai (in Cepheus), Caph (in Cassiopeia), Alpheratz and Algenib (one side of the Great Square), Diphia (in Cetus), Ankaa (in Phoenix), and Achernar (in Eridanus). A second imaginary line can be extended from Scheat and Markab (the other side of the Great Square) to Fomalhaut (in Piscis Austrinus). Kawelo was a famous King (Mö'i) of Kaua'i, who as a child flew a kite that became entangled with that of another boy named Kauahoa. As a result of this, Kauahoa's kite came down. The names of the four major stars in the Great Square are the names of Kawelo's four greatest ancestors, representing the islands of Kaua'i, O'ahu, Maui, and Hawai'i (PVS).





*Manökalanipö (Alpheratz, Great Square of Pegasus)*

"Shark of the heavenly night". The Mö'i of Kaua'i established the moku (district) and ahupua'a (land divisions) on that island, creating peace and prosperity. Since Kaua'i ali'i (royalty) had the highest rank of all the islands, it is appropriate to name Alpheratz, with the highest declination of the Great Square of Pegasus stars, after the famous ancestor and 'aumakua (personal god) of Kaua'i ali'i (PVS). Manökalanipö rises in Noio (Hawaiian tern) house, Ko'olau (Northeast), with a declination of +29°.

*Pi'ilani (Algenib, Great Square of Pegasus)*

"Climbing to the heavens". This Mö'i of Maui brought warring family factions back together, creating harmony and prosperity for the people. He established a great line of Maui ali'i who ruled over the waters between Maui, Moloka'i, Lana'i, and Kaho'olawe (PVS). Pi'ilani rises in Lä (sun) house, Ko'olau (Northeast), with a declination of +15°.

*Käkuhihewa (Scheat, Great Square of Pegasus)*

"To mistake a person for someone else". This Mö'i of O'ahu brought warring family factions back together, creating harmony and prosperity for the people. Käkuhihewa's court was famous for its devotion to the arts of hula, chanting, and oratory. 'Oahu ali'i were renowned as great navigators and voyagers around the Pacific (PVS). Käkuhihewa rises midway between 'Aina (land) and Noio (Hawaiian tern) houses, Ko'olau (Northeast), with a declination of -28°.

*Keawe (Markab, Great Square of Pegasus)*

"The tentacle of the octopus". This Mö'i of Hawai'i brought warring family factions back together, creating harmony and prosperity for the people. The octopus refers to this family's worship of Kanaloa. Keawe was an ancestor of Kamehameha, the father of the modern Hawaiian nation (PVS). Keawe rises in Lä (sun) house, Ko'olau (Northeast), with a declination of +15°.

*Ka Mö'i (Cepheus)*

"The King".

*Mäweke (Alrai, Cepheus)*

"To open up". Mäweke was the ancestor of the Kaua'i and O'ahu line of Mö'i and Ali'i Nui. He was also the ancestor of the four Mö'i represented by the Great Square of Pegasus stars (PVS). Mäweke rises in Haka (empty) house, Ko'olau (Northeast), with a declination of +77.5°, circumpolar in Hawai'i.

*'Iwa Keli'i (Cassiopeia)*

"Great Frigate Bird". 'Iwa is the frigate, or man-of-war bird (PVS). The bird points toward Höküpa'a. It is on the opposite side of the North Celestial Pole from Nä Hiku; thus, one of them can always be used to find Höküpa'a.

*Haumea (Segin, Cassiopeia)*

"The great one who rules". Haumea was an O'ahu goddess of childbirth, war and politics whose full name, Haumeanui-i-ka-äiwaiwa, means "the great one who rules the mysterious presence of the divine" (PVS). Haumea rises in Nä Leo (the voices) house, Ko'olau (Northeast), with a declination of +63.5°.

*Polo'ula (Caph, or Beta Cassiopeia)*

"Bird's Cut-off Wing". Polo'ula rises in Nälani (high chiefess) house, Ko'olau (Northeast), with a declination of +59°.



### *Kūkalani'ehu (Aries)*

"Kū of the misty heavens". Kūkalani'ehu was a war akua (god) of Kaua'i and O'ahu, similar to Aries (PVS).

### *Mö'ikeha (Hamal, Aries)*

"The supreme ruler". Mö'ikeha was famous for sailing from O'ahu to Tahiti and around the Society Islands. Later he returned to Kaua'i and became Mö'i of that island, and an ancestor of Kaua'i ali'i. His son Kila also became a famous voyager (PVS). Mö'ikeha rises in 'Aina (land) house, Ko'olau (Northeast), with a declination of +23.5°.

### *La'amaikahiki (Sharatan, Aries)*

"La'a (the sacred one) from Tahiti". La'a was an Ali'i Nui from O'ahu who sailed with Mö'ikeha to Tahiti and stayed there for many years. Mö'ikeha, who had returned to Kaua'i, eventually missed his hānai (adopted) son so much that he sent his son Kila to Tahiti to fetch him. When La'a returned with Kila, he brought new forms of Tahitian hula with him, and became famous as La'a from Tahiti. La'a mated with three Ali'i Nui wahine (high chiefesses) from the Kāne'ohe Bay area who gave birth on the same day (PVS). La'amaikahiki rises in 'Aina (land) house, Ko'olau (Northeast), with a declination of +21°.

### *Koholä (Cetus)*

"Whale". Named after the 'aumakua of Ali'i Nui.

### *Pi'ikea (Dipha, Cetus)*

"To become light, as the day". Pi'ikea was the daughter of the Maui Mö'iwahine Pi'ilanii. She married 'Umi, Mö'i of Hawai'i, making an alliance between the two kingdoms. When she arrived in Waipi'o Valley to meet 'Umi, she was escorted by 400 canoes laden with gifts and warriors (PVS). Pi'ikea rises in 'Aina (land) house, Malanai (Southeast), with a declination of -18°.

### *Halulu (Phoenix)*

"Man-eating bird" (PVS).

### *Kaikilani (Ankaa, Phoenix)*

"The small chief". Kaikilani was the first Mö'iwahine of Hawai'i Island, and her ascent to leadership united warring factions of the same family (PVS). Kaikilani rises in Manu (bird) house, Malanai (Southeast), with a declination of -42°.

### *Nu'uanu (Eridanus)*

Name of a long meandering river on O'ahu. This is the site of one of the earliest Hawaiian settlements (PVS).

### *Kalanikauleleäiwi (Achernar, Eridanus)*

"The chief whose altar is made of bones". Kalanikauleleäiwi was the last Mö'iwahine of Hawai'i Island (PVS). Kalanikauleleäiwi rises in Nälani (high chiefess) house, Malanai (Southeast), with a declination of -57°.

### *Ka'ahupāhau (Piscis Austrinus)*

Queen of the shark god who lived in Pu'uloa (Pearl Harbor), O'ahu, and who was renowned for navigation abilities (PVS).

### *Kūkaniloko (Fomalhaut, Piscis Austrinus)*

"Kū that resounds within". Kūkaniloko was the first Mö'iwahine of O'ahu, and was named for her birth place, the birthing heiau (place of worship) at Wahiawa. She and her daughter Kalanimanu'u built the fishponds at Pu'uloa

*(PVS). Kūkaniloko rises in Noio (Hawaiian tern) house, Malanai (Southeast), with a declination of -29.5°.*

*Nālani (Alnair, Grus)*

*"The heavenly one". Nālani rises in Manu (bird) house, Malanai (Southeast), with a declination of -49°.*

*Nālani'ōpio (Beta Grucis)*

*"The heavenly daughter". Nālani'ōpio also rises in Manu (bird) house, Malanai (Southeast), with a declination of -47°.*



## **Acknowledgements**

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