THE GREAT POLYNESIAN NAVIGATION EXPERIMENT

By Dan Twohig

It started as a practical joke. I wanted to see if I could hornswaggle a crew of sixty people into believing that I could navigate our ship from Hawaii to Alaska without a compass. It would be a "Polynesian Navigation Experiment". I would follow the teachings of Koloni Kienga, one of the last great Polynesian navigators and sail the ship as he would to arrive in Alaska without the aid of modern technology.

The idea for this project came to me when we first arrived in Hawaii in January 1992 aboard the 180 foot Coast Guard buoytender WOODRUSH. We were there for our biannual three month training deployment. As the ship's Navigation Officer, I spent many hours of my free time visiting maritime museums and reading books on Polynesian navigation. The subject of ancient navigation fascinates me.

One night towards the middle of our stay in Hawaii, I had enjoyed one too many "Mai Tais" at the Paniolo Cafe and was gazing at Ursa Minor from the beach where we would be camping for the night. The thought struck me that maybe it could really be done. Maybe I could sail the ship 2300 plus nautical miles without the gyro and magnetic compasses, the sextants, the chronometers and the electronic gadgets that man has developed and come to rely upon for safe navigation.

Of course after having briefed the captain on my plans for a grand ruse, it was a little difficult to convince him that I was no longer kidding and that I really believed that I could do it.

"Give me a ship and a star to steer her by". The principles were really quite simple: Ocean swells and wind driven currents can be predicted by the trade winds. Land birds will always seek out land. Ocean water tastes saltier near the equator. The Sun rises in the east and sets in the west and Polaris by any other name is still the North Star.

In order to navigate their outrigger canoes from island to island and so populate all of Oceana, the Polynesians followed the "star paths" that were handed down through the generations from navigator to

navigator. They tracked the land birds as they flew; home from their daily search for food, saw the surface currents in the shape of the wind ripples on the water's surface and identified the wave patterns reflected from distant islands. They tasted the water to give them an idea of where they were and how they were being affected by the elements. The navigator gathered all of this information to determine in what direction he must steer to find the tiny atoll that lived beneath the zenith star that his ancestors had promised him would be there.

The Polynesians never intentionally made ocean voyages longer than about 200 nautical miles. When they found that the storm winds had blown them to an unknown island, it sometimes took a generation or more to develop the star paths needed to find their way home. Often they never returned to their native islands thus stretching a little further the limits of their known world. There is no record of the Polynesians ever having voyaged into northern climates.

In theory I knew that it could be done. Since we would be traveling generally North Northeast it would be a simple thing to steer a course relative to Polaris at night, check the course at sunrise and steer on the ocean swells by day. The course would be checked again at sunset while we waited for Polaris and the zenith star that would signal the ship's arrival at our destination. I spent many nights stargazing from the beach and formulating my plans for the experiment.

We have all been taught in school that the shortest distance between two points on the surface of a plane is a straight line. Unfortunately the Earth is not as flat as our ancestors once believed. On the curved surface of the spheroid that we call home, the shortest distance between two points is a great circle. Therefore, to travel over any considerable distance you must alter course continually in order to correct for the curvature of the Earth. If you steer a straight course over more than a thousand miles you will miss your destination by several hundred miles. This endeavor was going to take some research...

The great circle route from Hawaii to Dixon Entrance Alaska would require a gradual course change of about seventeen degrees. I could use my outstretched hands, fingers extended to measure the altitude of Polaris and estimate our latitude. Bellatrix, a star in Orion the hunter, would be a good "over the shoulder" reference star if clouds were to obscure Polaris. And Dubhe, a prominent star in Ursa Major, would be overhead at the top(zenith) of it's nightly journey across the sky when we reached the vicinity of Dixon Entrance Alaska.

The date for our departure from the Sandwich Islands was set for March 14th. The plan for the

experiment called for leaving Honolulu and transiting Molokai channel by "seaman's eye", then beginning the experiment with a final look over the shoulder at Makapuu Point lighthouse. All electronic navigation equipment would be secured, all of the ship's compasses would be covered, and the radar would be left energized for shipping safety in the "head's up" mode only which would turn off the gyro stabilized function.

This was to be a test of my navigation skills. I would use only a hand held peloris to estimate my courses relative to the star that I was steering by, and these courses would be steered by the automatic pilot to remove the possibility of "helmsman error" clouding the results of the experiment. I would estimate our speed daily by tossing a chip of wood from the bridgewing and timing it until it passed astern.

In order to keep me from sailing the ship off the edge of the world, the captain (LCDR Larry Vose) would fix the ship's position daily by celestial means and keep a secret plot of our actual track.
A safety parameter of 100 nautical miles was applied to either side of our intended route to keep me from causing an international incident should I wander into someone else's territorial waters, or a mutiny should the transit to our homeport take unreasonably longer than planned.

Navigator's Log March 14, 1992

Underway at 0800 (8am), bound for Ketchikan Alaska. We started the Polynesian Navigation Experiment abeam of Koko Head, Oahu. The weather is lousy and it seems that I'm going to be seasick. I think that last piece of cold pizza (with the works) that I ate this morning with my grapefruit was a mistake. The seas are a choppy 12 to 15 feet on the starboard bow, the wind is out of the northeast at 30 knots. I commenced the experiment by shooting a relative bearing to Makapuu Point light. Our initial course is about 025 degrees True. At 0930 I changed course to about 035 degrees True to give us a better ride...

March 15th (Midnight)

I have estimated our speed at about 10 knots for the previous day. Our average course was 030 degrees True. The stars are out tonight and the seas have calmed down to about 5 feet. I brought the ship left to steer about 025 degrees True on Polaris. Dubhe looks good.

1200 (Noon)

I tasted the water today using the halved coconut shell dipper that took me several hours (and several coconuts) to fabricate with a hacksaw, "buck knife" and a spoon. I can honestly say that the water tastes less salty here than it did on the beach the other day. The "Polynesian chiplog" has us making 12.85 knots through the water.

We picked up our first albatross today. I am amazed as always at how a bird of that size can skim along the wave tops for such long periods of time without flapping its wings.

March 16th (Midnight)

The wind is still off the starboard bow. I estimate that we've made good about 025 degrees True and 12 knots for the last 12 hours. Guessing the set and drift by seaman's eye is a real challenge. I feel that we are about 25 to 30 nautical miles right of our intended track. I changed our course to about 022 degrees True on Polaris at midnight. We are starting to see a west swell.

1600 (4pm)

It rained all morning and afternoon. The water is noticeably colder, but I can't taste a difference in salt content. The wind has backed around to the Northwest. The seas and swells are building 8 to 10 feet on the port bow. This could be the last of the stars (and the experiment).

March 17th (Midnight)

There was no visible sunset last night; no evening stars and no horizon. At midnight there were stars for about 15 minutes. Our latitude is 32 degrees North by the "finger method". I'll hold our course relative to Polaris tonight. Dubhe still looks good.

I have observed all of the Polynesian navigator's signs with the exception of "current wrinkles" on the water. Maybe I am trying to see too much in the water, or maybe there is just no current. We sighted many flying fish and a few whales today. We passed through a school of tuna and you could see them shooting through the swells as the sea birds worked the feed that they had driven to surface.

0200 (2am)

Stars! I am more in tune with the night sky than I have ever been before. I have spotted 4 of Jupiter's Moons through the ship's pedestal mounted binoculars, the "big eyes". It is interesting to observe the Moon's orbit retard nightly and to watch Jupiter's position change in relation to the Moon. The wind is rising (25-30kts) out of the Northwest. The seas and swells are still building (10 to 12 feet).

1200 (Noon)

The chiplog says 12.1 knots. There are broken clouds and the wind is out of the North Northwest at 15 knots. The seas are 8 to 10 feet on the port bow with whitecaps, but the ride is not too bad. The water tasted less salty today and much colder. The air is colder too (sweater weather). There are now three albatross soaring back and forth in our wake.

1400 (2pm)

The seas are building. 10 to 12 feet with an occasional 15 footer broad on the port beam. The wind has increased to 35 knots. The barometer is falling and it looks like its going to blow...

We have been steering about 020 degrees True on Polaris for the last 24 hours. The next course should be 029, but the weather should be setting us to the right so I think I'll hold what we've got until this storm blows itself out.

March 18th (Midnight)

Stars! We're still steering about 020 degrees True on Polaris. The seas are 12 to 15 feet off the port bow. I estimate our position at latitude 36 degrees North (by fingers), 150 degrees West by DR (Dead Reckoning). I expect the seas to switch around to the bow. I think I'll hold this course until the weather dies, then fall off to about 025 degrees True. Dubhe approached zenith shortly after midnight tonight. Everything still looks good.

Its getting harder to tell our course by Polaris because of its increased altitude. I guess I'm running out of fingers to measure it with. I'm glad there is only one more course change. I can let the auto-pilot do the rest. It is amazing that the stars have been out every night. This is the North Pacific Ocean in March! The

Polynesian gods must be smiling (or is it laughing) at my efforts.

This weather should have slowed us down some for the day. The chiplog said 11.75 knots, but I'll give us 10.5 knots for the last 12 hours. I wish that the weather would calm down.

The captain does not seem to be the least bit concerned about our position. I estimate that we are close to being on track, but at best I feel that my dead reckoning position is good within about 30 nautical miles. It has not been as difficult to keep track of our position as I thought it would be. Although I have not looked at a compass since we left Hawaii, having Polaris appear even briefly every night has been as reliable as the gyro. Even in these seas I can tell our course within about 5 degrees. The dead reckoning plot is not a problem. It's estimating set and drift by seaman's eye that is tricky.

0200 (2am)

The seas are still off the port bow. I came right to about 025 degrees True on Polaris before I lost the stars for the night. This of course put the seas a little more on the beam which makes this round bottom ship roll like a pig. . So much for getting any sleep after getting off watch this morning.

1200 (Noon)

The weather has moderated somewhat. The seas are 6 to 8 feet on the port bow. I estimated 11.3 knots by the chiplog. The water still tastes salty but much colder. We almost lost the coconut over the side during the sampling.

I suffered a sort of vertigo this morning. When I got up the sun was high and I couldn't tell if we were headed north or south. It is strangely profound for me to realize that where we are is not nearly as important as where we are going. This is very contrary to my training. The lookout sighted a flock of stormy petrels. They flew North Northeast until out of sight. The engineers have secured the air conditioning system. These are signs to the navigator that we are headed in the right direction...

March 19th (Midnight)

No stars. I estimated 12.5 knots for the last 12 hours. The wind and seas have backed around to the port quarter. The swell is building indicating a distant storm coming our way. We set the clocks ahead an hour

tonight to conform to Alaska Standard Time.

0100 (lam)

Stars! Judging the course by Polaris is becoming very difficult. Dubhe is almost overhead at zenith. We should be a little left of track. I'd like to keep it this way to avoid a landfall in British Columbia.

1200 (Noon)

The weather is cloudy with rain. The seas are 6 to 8 feet on the stern and the swell is building 10 to 12 with an occasional 15 footer on the port quarter. I recalculated the great circle track this morning. I should have drawn it on the chart instead of trying to memorize it. I will need to make one more course change to 035 degrees True tomorrow or the next day. Unfortunately, the way the weather is building I don't think that I will get any more stars and I'll have to make the next course change by "eyeball".

1600 (4pm)

The seas are still building. They are becoming confused. The wind has shifted out of the South Southwest and the ship is really starting to yaw. It will be very hard to gauge (guess) set and drift tonight. The barometer is falling like a rock and the next low should overtake us this evening. I estimated 13.2 knots by the chiplog but I gave us only 12.5 for the last 11 hours (time change). The water has not tasted noticeably less salty in the last few days, but it continues to get colder. I saw my breath this afternoon.

It is hard for me to remember that the positions that I lay on the chart are nothing more than dead reckoning. The only indication that I have that I am not sailing into oblivion is that the captain has not even hinted to me that I need to change course.

March 20th (Midnight)

Stars!! Dubhe reached its zenith shortly before lam. Everything still looks good. I borrowed a third hand from the lookout and estimated 44 degrees North by the finger method. The

predominant swells are still on the stern and we are yawing badly. The wind has veered to the Northeast at 20 to 25 knots and the seas are very confused. I can identify 4 different wave systems now. We are steering about 025 or 030 degrees True and have traveled at about 13 knots for the last 12 hours.

I seem to have lost track of time. I looked at the calendar today and my ETA (estimated time of arrival) to Dixon Entrance is Sunday morning, March 22. I had thought that we wouldn't arrive until the 23rd. I feel "time vertigo" coming on. Could I have been that wrong? I'11 make my last course change to 035 tomorrow.

1200 (Noon)

The chiplog says we are doing 10.5 knots. I think we are going faster than that. The sea water is still salty and cold. The swell is building again to the west. It is about 16 to 18 feet with a long comfortable period. I changed course at noon by "eyeball". I tried for 035 but I may have overshot it by a little bit. The Sun is out and I'll have the opportunity to check the course at sunset. We have only a few hundred miles to go. It's time to start looking for signs of land. The most obvious sign I guess will be the birds.

Although I have been a navigator on this ship for a total of six years, I have never been more attuned to the speed and movements of the vessel. Considering the circumstances, I could be way off track and never know it, but I feel that if I can pull this off I will have proved to myself that in this world I can never truly be lost. It is the same feeling that I had the first time I worked out a celestial fix and got some viable results.

I can see the old navigators, the Palu, as with their arms outstretched they measured the sky and waited to absorb the mana of their gods. They learned to speak the language of reason, the Itang. And they learned that in navigation there is truth, in the night sky there is order.

1300 (1pm)

I almost ran over a sealion that surfaced right off of the bow. He looked pretty annoyed as he swam rapidly off to the West. I hope that he was Japanese, or maybe I should have followed him...

It looks good for stars tonight. Polaris has been so high in the sky that it is almost impossible to use. Dubhe is as close to being overhead as I can measure by eye. If Dubhe gets behind me I will have to turn right 90 degrees and head into the rising sun until we sight land.

March 21st (Midnight)

The stars are out again! I can't believe this is really happening. Maybe I'm not headed for Alaska... I came right to about 038 or 040 degrees True to steer on Dubhe as it rose in the evening. I have found that I can measure the angular distance between Polaris and Dubhe using the "finger method" and therefore know my approximate course. I had estimated that the final course on Dubhe would be about 035 degrees True. I am steering to the right of this to line up on Dubhe now. I must be left of track; but how far? Dubhe's rise above the horizon is almost vertical now. Its zenith is so close to being overhead that I can no longer measure it. It is very difficult to hang on for one more day without turning right and running for the beach. Here comes that vertigo feeling again...

1200 (Noon)

11.7 knots by the chiplog. I think that the water tastes less salty today. The air and sea temperatures are getting down right cold. I am becoming very attached to my coconut.

I recalculated the zenith of Dubhe this morning. Its zenith angle is closer to 56 degrees than the original 54 degrees that I had been using before. This means that since Dixon Entrance is at latitude 54 North, I will have to be steering a little to the right of Dubhe as it rises on the day we make landfall. It also means that I must be further to the left than I thought; but how far? I get no indication from the captain that anything is wrong; but I must be nearing the edge of the envelope.

This experiment has become a great test of my ability to figure set and drift based on the weather alone. If I had had to rely on the helmsman as opposed to the auto pilot I think that it would have been much more difficult to follow my star path. The few times that I turned off "Iron Mike" and tried to steer manually on the swells were nearly disastrous. Those old Polynesian navigators could really hand, reef and steer.

Land fall should be the NOAA weather buoys off of Dixon Entrance. If I am right of track we will sight the coast of Graham Island B.C. If we are left of track (and I'm pretty sure that we are) we will sight Forester Island National Wildlife Refuge, Alaska.. Landfall should be some time after noon tomorrow. I doubt that I will be able to sleep tonight after my watch. I consider my Dead Reckoning only good to within 50 nautical miles at best in all directions. My ETA therefore is only good within 4 to 8 hours depending upon

whether I am right or left of track, ahead or behind DR. Because of the time we have to kill before we need to be in Ketchikan, I believe that the captain will let the experiment run to its logical conclusion and allow me to make landfall where I may. Then we'll change course for Dixon Entrance.

All of the albatross are gone. We must be nearing land.

2200 (10pm)

I awoke with a feeling of dread. Something was wrong. I wandered up to the bridge to find that the 8 to 12 watch had maneuvered to avoid a tanker that was taking the great circle route to Japan. The deck officer said that he had come right "about" 20 degrees for a while, then left "about" 35 to 40 degrees for a while before returning to "about" his original course... He couldn't even tell me how long he was on each course. More error... I adjusted the course to about 5 degrees right of Dubhe. That should be about 045 degrees True. Where am I?

March 22 (Midnight)

Stars!!! Dubhe is so high in the sky that I cannot tell whether or not it has gotten behind me. With the weather being so good for the last couple of days, there has been no obvious signs of set and drift. It is taking every bit of self control that I can muster not to turn the ship due East and make a run for the beach.

I was reading this evening about the ceremony of "Pwo." This is the Polynesian rite of passage from student to navigator. This ceremony consists of the elders making profound speeches, eating specially prepared foods, and drinking the fermented juices of local roots. The student then makes a ritual solo voyage in a canoe that was built specifically for this occasion. Upon the student's return (if he returns), he is declared "Palu", a navigator, and a place is then made for him in the circle of navigators in the canoe house of the Palu. The feasting begins anew as the island celebrates the passing of the Palu's mana to a new navigator who will be responsible for leading the island's canoes to the best fishing grounds, and keeping open the crucial inter-island trade routes.

If we make Dixon Entrance tomorrow plus or minus 50 nautical miles I feel that I will have accomplished something very special amongst my peers. Considering that this endeavor started as a

joke, developed into a viable plan and then a major accomplishment (maybe), I will be quite elated if it ends well tomorrow.

0900 (9am)

I had my first "landfall dream" (running aground) at about 5am this morning. Needless to say, sleep was fleeting after that... I got up at 0830 and wandered to the bridge. A seagull was flying along beside us. It stayed with us for about 10 minutes before flying off to the West. Maybe it was Japanese too.

My modern analytical mind is solving conical "mini-max" solutions for our landfall. I have drawn a bulls-eye on the chart, the outer ring being 100 nautical miles.

1123 (11:23am)

Landfall! The lookout sighted land off the starboard bow. It looks like a small mountainous island off the coast of Graham Island British Columbia The captain came up and not knowing the elevation of the island I estimated our position visually as 20 nautical miles from the island, or 20 nautical miles right of track. Together we uncovered the GPS unit. The GPS had us 32 nautical miles from that island, or 12 nautical miles left of track. SUCCESS!!!

Alaska has never looked so good. The chiplog has been amazingly accurate. My ETA was good within 3 hours and after a passage of 2382 nautical miles, my cumulative error was 12 nautical miles. I am finally relieved of the anxiety of not knowing where I am. It feels strange to look at a compass again.

2100 (9pm)

We are sailing through Dixon Entrance. Only 3 more hours until we tie up in Ketchikan. The sky is clear again and the stars are visible in unfathomable number. I stood alone on the fantail with my arms outstretched trying to measure the night sky and commune with the gods of Koloni Kienga. I want to thank them somehow for the use of the stars. I looked again into the sky overt the mountains to the North andsaw the beginnings of a grand display of northern lights. The green, red and blue sheets of light shimmered and danced before the vast carpet of twinkling lights. The aurora will probably build into the wee hours of the morning. I truly do love sailing the waters of Southeast Alaska..

The Polynesian gods have blessed our voyage with stars and have sent the aurora to welcome us home. My mind is swimming. I have begun to feel the mana of the Palu. I fear losing this treasure before I've had the opportunity to fully understand its value.

Epilog:

We arrived in Ketchikan at midnight. A driver was sent to procure the necessary materials to celebrate our return to Alaska. As I stepped from the ship at the bottom of the gangway, I was greeted by my captain and the several members of the crew. The coconut shell that had served me so well during the trip was hung from my neck on a short lanyard and filled with Irish whiskey. The first taste was a little salty... I moved from crewman to crewman offering a taste of the mana that I had gained and thus allowing my friends to share in my triumph. This was my Pwo.