

The Canoe Is the People

Indigenous Navigation in the Pacific



CANOES AND SAILING



United Nations
Educational, Scientific and
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Local and Indigenous
Knowledge Systems



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Canoes and Sailing

Ko te iwi te wairua o te waka, ko te waka te wairua o te iwi ... the people are the spirit of the canoe, the canoe is the spirit of the people.

Maori saying

In Aotearoa (New Zealand), one of the last places to be *settled** in the Pacific, every Maori iwi (tribe) is connected to the crew of one of the big canoes that first arrived there. This is the starting point of their whakapapa (family line, history). Waka, the word for canoe, can be used in many different ways – for example, to mean a project or voyage done together, both physical and spiritual.

Canoes were (and still are) of great importance to Pacific peoples. In the past, they were the way to travel, trade, and get food. They were part of stories and the work of everyday life. The whole community had huge respect for them. The Pacific peoples developed different types of canoes and ways of sailing for different purposes.



Video 1 - Cook Islands navigation students

Cook Islands navigation students Te Aru Rangi Reitu (Rangi, left) and Kaiki Tarangi (Karl, right): We're introduced to this vaka as if it's our mother. We treat it with respect. We pray as we board, and we don't leave the vaka until we say goodbye through prayer to the vaka and respect it right throughout because our mother will save our life. We need to love that vaka just like our mother. And another thing, whoever goes on the vaka adds to the mana or the prestige of the vaka, so that's another spiritual way. The people who have stood on that vaka – and as we stand on it, we stand with them.



Video 2 - Sir Tom Davis (Papa Tom)

Cook Islands canoe builder and navigator Sir Tom Davis (Papa Tom): I consider that the development of the big voyaging canoes, and the technology of navigation by people who became masters of it, is equivalent to the space programme for its time.

* NOTE: Definition of words in *italics* can be found in the Glossary in the CD-ROM Storehouse.



Video 3 - Satawalese senap (master canoe builder) Edward Remoi

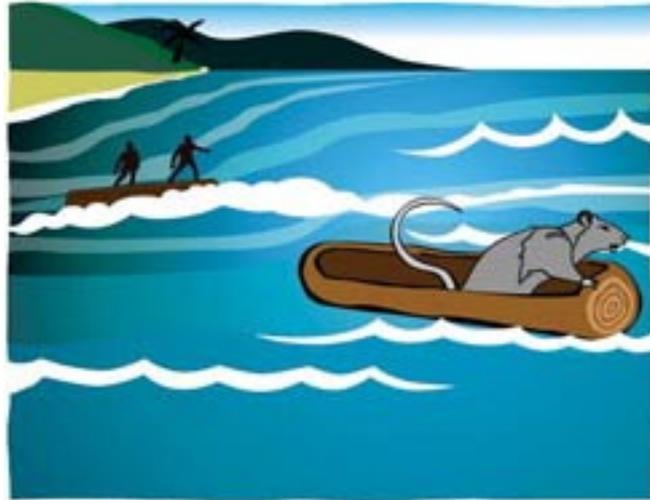
If you want to learn how to be a navigator, then you also have to learn how to make a canoe. The two are related: navigation and canoe making. It is good to be both a navigator and a senap. Otherwise people may say, "You just know how to navigate, but you don't know how to make a canoe." Also, you will have to borrow a canoe. But if the people you ask don't lend it, then you will not be able to travel anywhere. If they don't want to lend their canoe, what are you going to do?



Video 4 - Maori carver Te Aturangi Nepia Clamp

On Te Au o Tonga, around the canoe there's a design called tikitiki tangata, which is a design that, when you look at it, it's people's hands linked, and that goes all the way around the canoe. Now, that's a design that was put on there to protect the canoe. That's a carving that represents our ancestors, that represents our genealogy, and that represents our kaitiaki, which are our guardians.

**Story 1 - The First
Canoes (Vanuatu,
Melanesia)**



Nobody lived on the island of Vao. The only way to get there from Mallikolo (Malekula) was to swim. One evening, the people of Mallikolo heard scary sounds coming from Vao. Then their food started disappearing overnight. One morning, a woman screamed that her toe had been eaten!

Many days and nights passed, and more food and toes were eaten! Then, one day, a guard saw a rat speeding away. He chased it, but it jumped onto a hollow stick and floated towards Vao. The chief ordered some men to swim to Vao and bring back the missing toes. The men were afraid of sharks in the sea, so they copied the rat and built a raft. They cut down strong pieces of bamboo and tied them together with coconut rope.

The men were away a whole night, and the villagers were worried. When they finally returned, they didn't come in their raft. They had carved a canoe like the rats' hollow piece of wood. Their canoe was big and strong because they had carved it from a tree. Later, they carved many more canoes. When they had a whole army, they attacked Vao. The rats tried to escape on the sea, but a storm drowned them all. Since then, the people of Mallikolo have used canoes to travel between islands ... and they've kept all their food and toes!

1 Pacific Canoes

After *rafts*, Pacific *dugouts* were some of the first boats in the world ... and a technological breakthrough that allowed people to explore the Pacific.

Thousands of years ago, when melting ice flooded South-east Asia and formed tiny islands in a large sea, the Pacific Islanders had to develop better canoes to carry people and link communities. By adding an *outrigger* to the single hull dugout, they stopped it from rolling over. By adding sails and more wood to the sides of the hull, they made the canoe fast and safe enough to explore the open sea to the east. By making the outrigger the same size as the main hull (a double hull), they made a canoe that could survive storms better and carry more things like crops and animals [See figure 1].

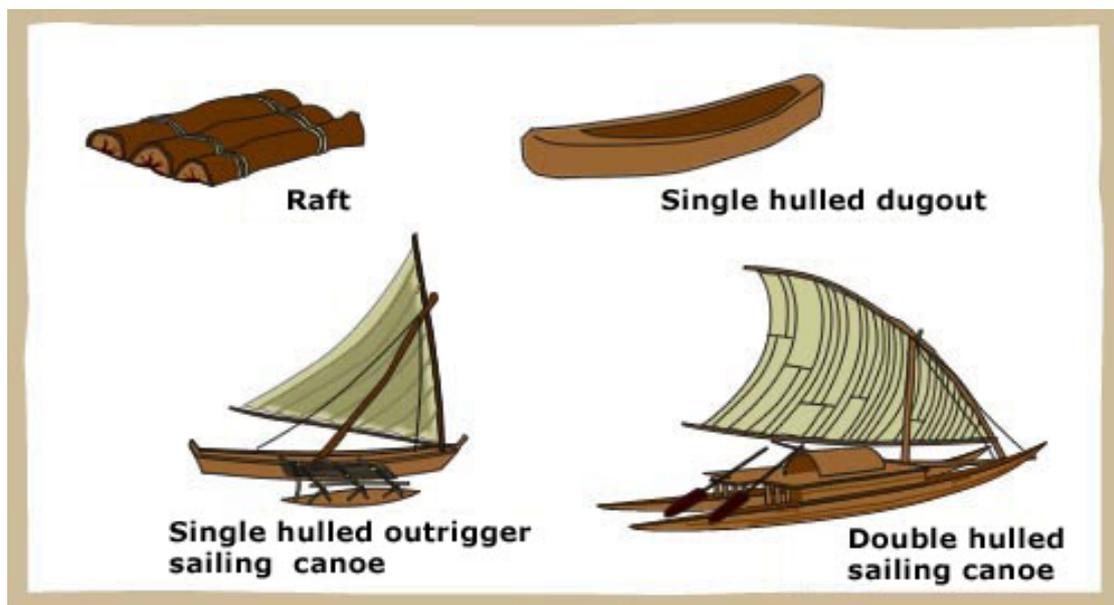
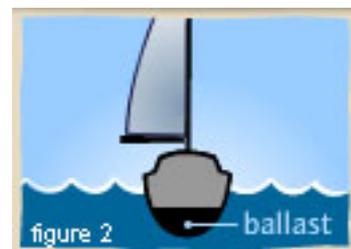


Figure 1

Outrigger canoes were good for fast trips to nearby islands and for chasing tuna. The stronger and more stable double hulls were ideal for *settling* new islands. Most sails were triangular. Their shape was good for sailing across and into the wind and for giving a lot of lift to the canoe. Some were quite small – made for safety, not racing. After all, a large sail increases the chance of a canoe *capsizing*.

By comparison, boats in other parts of the world (for example, Europe, Africa, and China) were mostly used to carry heavy goods like metal and cattle along the coasts. They had to be large and so needed many sails. The more sails they had, the more *ballast* they needed to stay upright in the wind [See figure 2]. As a result, they were slow. They didn't need to be as *seaworthy* as Pacific canoes because they could stop on land every night.





This stone carving (from the Borobudur Buddhist temple in Indonesia) is the oldest known image of a double outrigger (in this case a ship) and dates to about 1200 years ago. It is believed that ships of this type were sailed by Indonesians as far as Madagascar, off the coast of Africa.

This image is from the ArtServe website of The Australian National University, maintained by Dr Michael Greenhalgh (http://rubens.anu.edu.au/htdocs/bycountry/indonesia/borobudur/reliefs_small0012/1200b.JPG).



Photo © Peter McCurdy

Single-hulled paddling canoe with or without tacking sail

This canoe was used for travel, fishing, and war. Examples are known from the Solomon Islands and Aotearoa (New Zealand).



Photo © Peter McCurdy

Outrigger paddling canoe with or without tacking sail

Used throughout the Pacific (at different times in history), this type of canoe was used daily for travel and fishing. Examples are known from Vanuatu and Aotearoa (New Zealand).



Photo © Peter McCurdy

Double-hulled paddling canoe with or without tacking sail

People went to war in this canoe in the eastern Pacific. Examples are known from Tahiti, Aotearoa (New Zealand), and Hawaii.



Photo © Hans-Dieter Bader

Outrigger sailing canoe with tacking sail

This canoe was used in the central Pacific for travel and fishing. Examples are known from Samoa and Tahiti.



Photo © Richard Moyles

Outrigger sailing canoe with shunting sail

This canoe was used for travel and fishing in the northern and western Pacific. Examples are known from the Marshall Islands and Fiji.



Photo © Peter McCurdy

Double-hulled sailing canoe with tacking sail

In the central Pacific, this canoe was used for voyaging. Examples are known from Tonga and Tahiti.



Photo © Gillian Chapelle

Double-hulled sailing canoe with shunting sail

After the double-hulled sailing canoe with tacking sail, this canoe (with a different sail) was developed for voyaging in the central Pacific. Examples are known from Fiji and the Tuamotu Islands.

2 Building a Canoe

If you want to build a canoe, first plant a garden.

Ni-Vanuatu saying

Building a large sailing canoe can take more than a year. It can only begin if the right trees have been planted and are ready to use. A spiritual expert often performs a *ritual* to ask the spirits for permission to cut down a tree. The experts might be paid with valuables like weaving and food as well as shown great respect. Another expert guides the canoe builders. In Satawal, he's called a senap (master canoe builder). Young children watch, and older boys help out.

Before Europeans arrived in the Pacific, people used things from the world around them to build canoes – like stone or shell axes to cut the trees and shape the canoe parts. There were no steel tools and certainly no chainsaws like today! A canoe builder knows which trees are good for different canoe parts. The wood for hulls must be strong and long-lasting but not too heavy. Other canoe parts – like the outrigger and the sleeping platform on Satawalese canoes – are made from softer woods. Some of the wood used for the sleeping platform is brought by ocean currents from unknown places. If a community doesn't have building materials or a canoe builder, they may trade for canoes from other islands.

After the canoe is tested, there's a ceremony to celebrate. In Satawal, they throw food all over the canoe. When they're finished, they feast!



Video 1 - Cook Islander Dorice Reid

They learned how it was that our ancestors had this enormous respect for the environment. For instance, in the olden days, our ancestors would never cut a tree down to make a canoe without praying, without their karakia, praying for authority to take the life of that tree. Today, we just blatantly go and cut a tree down, and we don't think about the fact that it has a life.



Video 2 - Maori master canoe builder, Hekenukumai Busby (New Zealand)

There is a specific prayer that allows you entry into the forest. Things today are different from the past. I was committed to following as closely as possible the ancient rituals of my ancestors in entering the forest. One of these prayers is a prayer of preparation to make the first cuts on a tree after selection. Next comes a ritual that burns the first chips so that their energy can be released into the forest through the smoke generated by the fire.



***Video 3 - Satawalese senap
(master canoe builder) Edward
Remoi***

Satawalese senap (master canoe builder) Edward Remoi supervises the construction of a large voyaging canoe. Construction is a group effort involving many men – from boys to adults. Many different tools and techniques, both ancient and modern, are used. It is an exceptional opportunity to pass down knowledge and know-how to young boys who are eager to observe, participate, practice, and learn.



***Video 4 - Satawalese senap
(master canoe builder) Edward
Remoi***

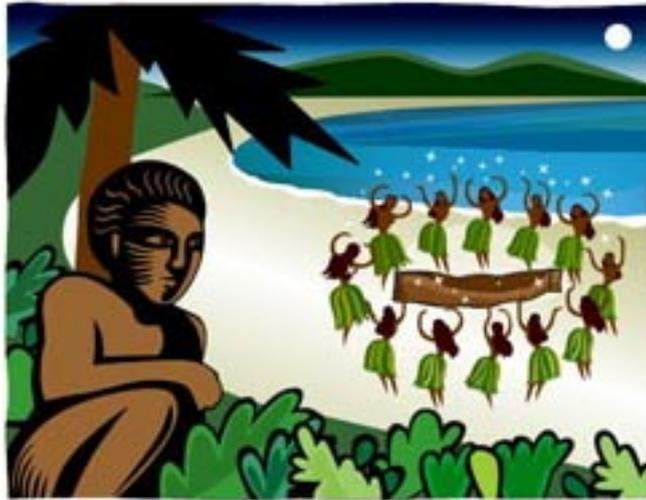
They choose the old, old breadfruit to be the puun (hull of the canoe) – the one with the red skin and hard wood. It is very important to choose hard wood. The breadfruit for the tam (outrigger) is lighter. It is called mesaruuw. If they use the hard wood for the tam, the canoe will not be balanced. The tam will sink.



***Video 5 - Maori master canoe
builder, Hekenukumai Busby (New
Zealand)***

Voyaging canoes can be built from almost any tree, but the waka taua or waka tete requires trees that are heavier on one side than the other so the canoe doesn't capsize. In 1975 an elder taught me which trees were ideal for this. These trees were ones constantly exposed to the westerly winds. In these trees you will find the heart of the tree is closer to the western exposed surface. This is what you look for to build a waka taua or a waka tete.

Story 1 - The Story of Lata (Samoa, Polynesia)



Lata was the son of Fafieloa and Tula. When Fafieloa was killed by Matuutaotooto (from Savaii), Lata wanted revenge. Lata went to find Matuutaotooto, but he had already escaped in a fast canoe. So Lata decided to build a canoe too. He cut down good tamanu trees. He worked hard. When the sun set, his canoe was nearly finished.

The next day, Lata was shocked. The canoe was gone! The trees were standing as before! So Lata cut them down and built the canoe again. The next day, the same thing happened. Once again, Lata cut the trees and built the canoe. That evening, he hid to find out what was going on.

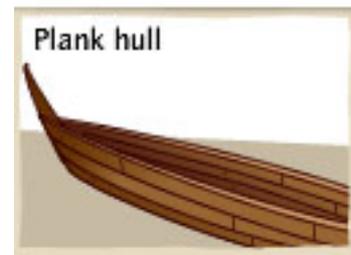
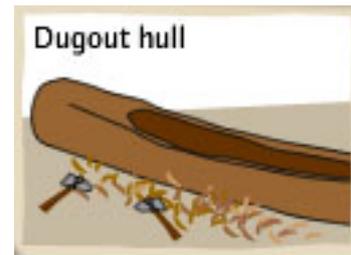
Soon, twelve female spirits appeared. They danced and sang, “Fly up and stick together, branches and leaves. Stand up, our children.” They asked Lata, “Why are you cutting down our children? Did you bring an offering to Tane, the god of the trees?” Lata cried out to be forgiven and promised to prepare an offering. When the spirits saw that Lata was truly sorry, they built the canoe for him!

Lata was overjoyed. He asked the priest to bless the canoe. Then he sailed away, looking for Matuutaotooto. Finally, he found him in Tonga. He killed Matuutaotooto and ate his heart. Some say that before Matuutaotooto died, he put a curse on Lata's canoe and it broke. Others say that the Tongans took the boat apart to learn how it was made and that this is the origin of the first alia (double-hulled canoe) in Tonga.

This story is similar to other stories told in the Pacific Islands — for example, the Micronesian story of Rongerik and Rongelap and their canoes and the stories of Rata from Aotearoa/New Zealand, Tuamotu, Tahiti, and so on.

2.1 Hulls

The way a hull is built depends on the use of the canoe and available materials. You need big trees to build a *dugout*. On islands that have no big trees, such as those of Western Kiribati (Gilbert, Phoenix, and Line Islands), pieces of wood are shaped into planks and fitted together. Other planks are tied from the inside to give support. Before iron nails, Roman and Egyptian ships were made like this too.



These are the two oldest ways to build hulls. People refined them more in the Pacific than in other parts of the world, and this enabled them to travel far on the open ocean. By fitting and tying all the parts together, Pacific people made very solid canoes – but also *flexible* ones. When sailing, the canoes could absorb the force of the waves better than more *rigid* European boats.

If a canoe is used for fishing in lagoons, or if a place rarely has strong winds (like the Solomon Islands), it doesn't need side planks. But if it's used for voyaging between islands, where the seas are high, side planks are necessary. Balance is essential for these voyaging canoes. The hull shape, especially the distance between the two hulls (or hull and outrigger) has to be just right. Carvings on the hulls often have spiritual meaning and are there to protect the canoe.



Canoe Building

Aotearoa war canoe

In the past, the largest canoes were for wars or ceremonies, not voyaging. The dugout war canoes of Aotearoa (New Zealand) were usually made from three large pieces fitted tightly together – hull, bow (front), and stern (back). Planks were added to the sides of the dugout. Carvings in the styles of individual iwi (tribes) were put on top of the bow and stern.



Photo © Peter McCurdy



Photo © New Zealand Maritime Museum

The sharkskin surface on this Maori river canoe and other hulls in Aotearoa is difficult to explain in western terms. Pacific Islanders find that the sharkskin surface makes the hull faster than a smooth hull.

Walap

The Marshall Islands walap canoe also has three pieces, but not fixed together in the same way as the Maori war canoe. There are few large trees on the islands, so many planks make up the walap's sides. The outrigger is connected to the main hull in a flexible (loose, easy to bend) way. Like this, it can hit the waves first and ride over them separately from the main hull. This means less stress on the canoe and less drag (the friction of the water against the hull) in the water, so the canoe can go faster. Western designers have copied this clever feature.



Photos © Peter McCurdy



Satawalese canoe

Like the Aotearoa (New Zealand) war canoes, Satawalese canoes are built in three pieces, but they are much smaller because the trees are smaller. Therefore, more planks are added to build up the sides.



Photo © Karen Nero

2.2 Sails

Before modern sailcloth was available, women and girls used to weave sails from strong leaves like pandanus. (In some places, like Satawal, they still know how to do this.) They collected leaves that were long and *flexible* but not too young. They stored them in the women's house until they had enough to make a sail.

The women sat on the floor to weave the leaves – like weaving a mat. Then the sail was cut to the right size and shape. The edge of the sail was made especially strong to resist the pull of a big wind. Small girls learned first by watching and then by practising. Weaving was one of the many things that they learned at the women's house.



An original Maori sail from the British Museum, London.
Photo © Hans-Dieter Bader.



Video 1 - Satawalese Terese Lachielmwar and Teresa Nauweilug

When we pick the maang (leaves) of the far (pandanus), we remove the mwonanmaang (thorns). They hurt if you prick yourself. The good leaves are the ripe ones. These are the bad parts (the base and the end). We throw away these no-good parts. We divide the leaves. Then we roll the strips. This is called aoun. We use the knife to make them straight.

We do the weaving of the uw (sails) in the women's house. We divide the leaves into narrow strips. We put one down and then another. If other women are weaving, we join the strips. We count the leaves. It's usually a hundred or longer. Then the men come to measure and cut it. They try the sail on the canoe and sew it into the final shape.



Video 2 – Testing a large sail

On the island of Satawal, a large sail is tested on a new mast in order to fine-tune its shape and size.

Story 1 - How the Sail Came to the Outrigger (Marshall Islands, Micronesia)



Ten brothers were to have a canoe race to decide who would become chief of the island of Jeh. Each boy carved a strong paddle. The bigger boys showed off their skills and made fun of the younger ones. The smallest boy, Jabro, was quiet.

When the race began, their mother, Liktanur, asked each son to take her and her heavy load on his canoe. They all said no except Jabro, even though he knew it would slow him down. For his kindness, his mother showed him how to use the sail, which she was carrying in her load.

Jabro beat all his brothers in the race and was called Jabro-Jeleilon, Iroj, the Wind Catcher. As the sons of Liktanur finished their lives on earth, their mother took them up to the night sky. Liktanur is now one of the brightest stars above the Marshall Islands. Each son can be seen in his correct position to guide ocean voyagers. The only star close to Liktanur is Jabro.

2.3 Ropes

A lot of rope is used to tie canoe parts together and to make the *rigging*. Very strong rope is made from plants like vines, hibiscus, and coconut. This is the process for coconuts.



Video 1 – Rope making

You put coconut *husks* in water for some weeks to remove the soft, weak parts.



Video 2 – Rope making

After, you dry the wet *fibres* in the sun and then join them together in small bunches.



Video 3 – Rope making

To start a length of rope, you pull a few fibres from the middle of the bunch and rub them together against your thigh.



Video 4 – Rope making

Then you rub the end of the first group of fibres together with the end of the next few fibres, and so on.



Video 5 – Rope making

To make thick rope, you weave several of these lengths together. Many people help make the rope.

From The Last Navigator © INCA 1989.
Directed by Andre Singer.



Video 6 – Rope making

Rope-making is a skill that children learn and practice from an early age.

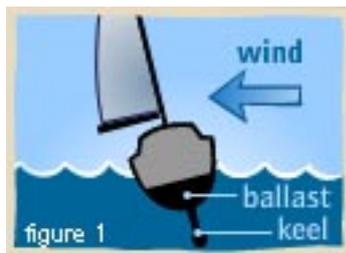
Satawalese navigator Anton Ratiloinug: Now I am preparing to make muuch (rope). We pick up nuu (coconuts), and we remove the husks. Then we put them in the nip (fresh water ponds in taro growing areas) for some months. We use this koor (wet coconut fibre) for many things. We use it for anon (coconut fibre rope). You can make a lot of types of rope.

3 Sailing

The wind on a sail can push a canoe right over. Therefore, most European boats have a deep, heavy *keel* that works against the force of the wind to keep the boat upright. They also have a heavy *ballast*. Both the keel and the ballast slow the boat down [See figure 1].

Pacific canoes are different. They sail by working with the natural forces of the wind and water. Because of this, they don't need extra weight to stay upright. Instead of having a deep keel in the water, the outrigger canoe puts the balancing weight (the outrigger itself) to the side – a clever solution because it doesn't slow the boat down [See figure 2]. The canoes don't crash through the water because their parts are *flexible* and move with the waves. This means less stress on the boat and less equipment failure, which is essential for long voyages. The canoes are built with very few materials. This is important on islands with few resources.

It's not surprising that the lightest and fastest boats in the world today are modern catamarans. Their designs are based on Pacific double-hulled canoes!



Video 1 - Satawalese kids play with model canoes

Maverick Eranginug and other Satawalese kids play with model canoes. They learn how a canoe behaves in the wind and water – first without a sail and later with one. A father makes several model canoes for his sons as they grow up. Sometimes the boys make the boats themselves. If the father is a navigator, he takes his sons on a canoe and teaches them more. When the boys are ready, he lets them sail a real canoe for practice.

From *Becoming a Navigator, Becoming a Priest* © UNESCO 2004. A film by J. Blumberg, R. Hunter-Anderson, R. Apusa, and B. Feinberg.



Video 2 - Maori master canoe builder, Hekenukumai Busby (New Zealand)

After we launched the canoe many things needed adjustment. In 1992 we wanted to sail to the festival in Rarotonga. Despite being a difficult time of year we decided to try. Te Aurere had one mast then. We had an international crew. One Hawaiian, Mau and a nephew, the remainder were our youth. The storms during that voyage severely tested us for seven days. Our two steering paddles were destroyed and we were assisted in to Rarotonga by our support vessel. Once we got back to New Zealand I made changes to improve her sailing performance.



Video 3 - Young men from Satawal practice sailing

Young men from Satawal practice sailing.



Video 4 - Hoturoa Barclay-Kerr of Te Toki Voyaging Trust

I encourage the kids to read and write and do all those kinds of things, but I also encourage them to be very experimental in the things that they do. So when we have the canoes out, especially if it's a good day, I'll say to them, OK, if we've rigged it up for sailing, so OK, what will happen if we do

this, if we make this change to the canoe? What happens to the physics of the canoe if we tilt this mast forward a little bit? Or what happens if we move you all to the front of the canoe? How is that going to affect the performance of the canoe? How are we going to try to make the canoe go faster? How are we going to make it come up into the wind a bit better? All those little things.

3.1 Tacking and Shunting

A sailing boat can sail close to the wind, across the wind, and with the wind from behind. But it can't go directly into the wind because the sail can't catch any air. If its destination lies in the direction of the wind, the canoe has to sail in a *zigzag* pattern towards it.



The most common way to do this is to tack. The canoe sails on an angle to the wind. With enough speed, it turns its front through the wind. The sail flaps and then fills again on the other side. All European boats and many Pacific canoes tack like this. Tacking canoes are good for the changing winds around headlands, like those in Aotearoa.

Another way to sail into the wind is to shunt – to swap the front and back ends of the canoe. The outrigger of a shunting canoe is always on the side opposite the sail, so the canoe is well balanced. However, shunting is more difficult than tacking. It's good for places with steady winds, like Micronesia, where it was developed. The people in Fiji, Tonga, Samoa, and the Tuamotu Islands also shunted because this way of sailing suits long-distance canoes.

3.2 Balance

All Pacific canoes are designed to balance the forces of the wind and water. The shunting canoe is a good example of a balanced system based on advanced ideas. The hull, outrigger, and sail form a balanced triangle. The outrigger balances the pressure of the wind on the sail. It rides over the waves not through them, so it doesn't hold the canoe back. The crew moves in relation to where the forces of the wind and the water are acting on the canoe. Everything works together.

1. When the canoe travels with the wind from the side, the sail is nearly in line with the hull. The sail's centre of effort (the centre of the wind's force on the sail) is close to the middle of the hull. This way, the canoe is balanced, and so steering is easy. A small pull on the steering paddle or on the ropes that control the sail will guide the canoe [See figure 1].

2. When the canoe moves towards the wind, the force of the wind on the sail moves forward. The hull's centre of effort (the centre of the forces on it) also has to move forward to keep the canoe balanced. To achieve this, some of the crew move towards the front of the canoe [See figure 2].

3. When the canoe travels with the wind from behind, the opposite needs to happen. The hull's centre of effort has to move back to keep the canoe balanced, so some of the crew move back. The steering paddle can be put deeper into the water too. The deeper it is, the closer the hull's centre of effort is to the back [See figure 3].

