

# Cargo Proa Prototype

## Building Blog



### FEBRUARY 2024

Zero emission shipping things are starting to happen at CATD. Not least because we have usable boats in the water. One of the upshots of this is an increase in curious visitors, many of whom are doing interesting things, but need sustainable transport to make them happen.

We fitted the 5 x 300W solar panels to the Rewa water taxi prototype built by the students and powered by the outboard converted from petrol to electric. It worked a treat. The photo and video show it operating under 2 of the panels (600W, less than 1 horsepower), no battery. Top speed was 4 knots, with 2 people on board on a cloudy day.

We are now waiting for MSAF approval prior to fitting batteries and taking it down to Rewa, a 6 mile open water trip, followed by 9 miles of river. Once it arrives, it will be used by as many drivers and passengers as possible and the feedback will be used to design the production version. These will be built by graduates of the Sustainable Boat Building program in the new UN Innovation Hub at CATD.



25 years ago, I realised that kites are by far the best way to use the wind to power boats. Why? They are attached to the deck, so there is no heeling, they require minimal deck gear so they are far cheaper than conventional rigs and they can be flown high where the wind is stronger and more consistent. On the down side, (and what I and many others have spent a fair bit of that 25 years looking for solutions to), they are difficult to launch and retrieve on a small/medium boat, have the potential to unexpectedly quadruple their power output if not carefully controlled, are a nightmare if they fall in the water and have kms of small diameter string which tangles easily.

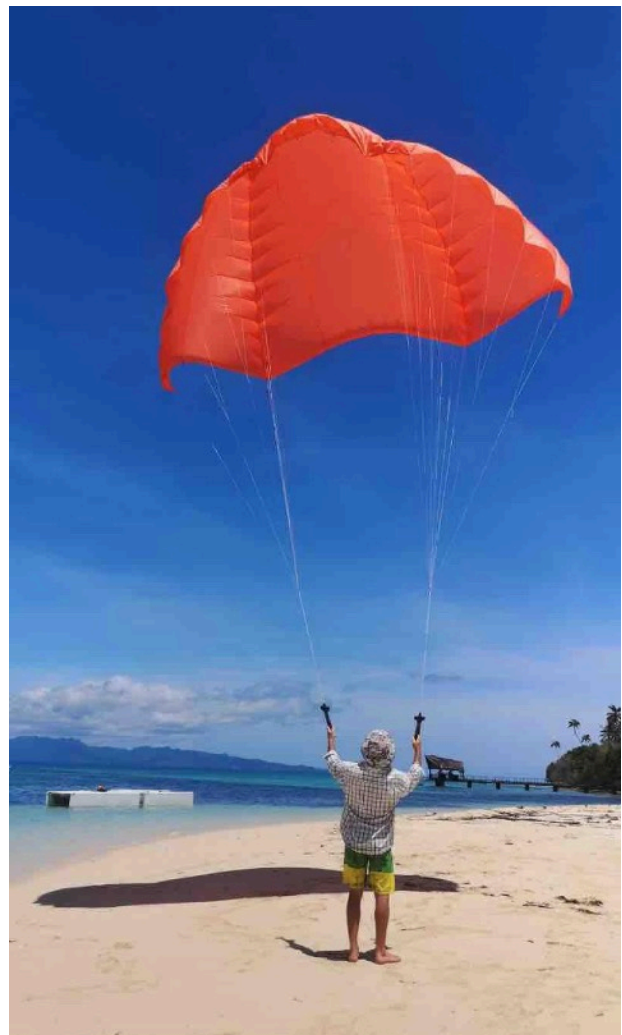
I spent a couple of days pre Xmas with old friend Trevor Jack on KitetiK, a 15m harriproa used for testing kite ideas. We used a kite handling system devised by Trevor and a 17 sqm/183 sq' (projected area) paraglider, modified to fly like a kite board traction kite. It took a while to get it set up, (once we mark the lines it will be set and forget) but then we could leave it and steer wherever we wanted to from hard on the wind to broad reach with no one touching the kite. Launching and retrieving was simple, using the mast to hoist and retrieve the kite. Once flying, all the loads were taken by a single strong point on the deck. This is a huge contrast to a sailing rig where the sail force acts half way up the mast and the loads to shape, control and support the sails are an order of magnitude higher than the force propelling the boat. As a bonus, the kite loads are lifting the boat, whereas conventional rigs act to heel the boat and depress the bows.

17 sq m is about 1/3rd of the designed sail area, not much more than a conventional storm rig. We managed 6 knots top speed in maybe 10 knots breeze (no white caps, despite wind against tide) shunting through 90 degrees upwind.

This performance and ease of handling was impressive enough to justify bringing Trevor and Gavin Mulvay (kite, electronics, EV's, and a whole bunch of other things guru) over to Fiji to try it on the tender for the cargo proa. Gav also cut and sewed a different type of kite which may be easier to use.

I had 2 weeks to finish and install a lee (actually a weather) board and a mast (one of the booms for the mini cargo proa crabclaw rig), make a paddle and set it up for steering. The mast's sole purpose is to launch and retrieve the kite. Once it is flying, the mast does nothing and is unloaded, or so we thought.

The guys arrived and we spent a couple of days sorting things out, doing some test runs, installing the bridles on the kite Gavin made and then set off



for Leleuvia, 12.5 miles/20 kms away. A broad reach, barely 10 knots of breeze, with the paraglider/kite from KiteteK. Raising and lowering it was simple using the mast. Pull it up, release a string and it gently fills. How gently is controlled by the string release speed. Reverse the procedure to drop it. Shunting is a couple of seconds of pulling lightly on one line. Faster than the time it took to get the paddle from one end to the other.

Top speed was 9.6 knots, all went smoothly until the mast broke between the bearings. A function of the small bury (distance between the bearings) waves from the side and a spar not designed for the job. Nothing to do with the kite.

We spent 2 pleasant nights at Leleuvia and took the boat for a shallow water reach along the beach with a hand held 2.5 sq m/27 sq' kite. Got along at about jogging pace with not much leeboard down. I'd definitely carry one of these (maybe a bit bigger) as an emergency kite.

We also test flew the kite Gavin had built. It needs tuning, but has potential. We jury rigged the mast with stays for the trip back. Repeat of 9+ knots top speed in similar breeze but the stay angle was insufficient, so we broke it again in the cross seas,

nothing to do with the kite. We had a play with a couple of hand launched kites, then the breeze died, so we called for a tow to CATD. Gavin had to go home, so Trev and I rigged an inverted Y mast using bamboo. Much stiffer, but we managed to break this too. Definitely a function of the kite this time. We learnt a lot of lessons, not least that big kite techniques on small boats are difficult and kite selection is important. On the bright side, the problems with the masts will not apply to the cargo proa, so we are proceeding with the build of 2 large kites.

#### Video 1



#### Video 2



The tender is an 8.5m/27' catamaran with 400mm/16" wide, double ended hulls, flat bottom and no rocker. It weighs about 250 kgs/550 lbs and draws about 20mm (3/4") empty. A bit more than double both of these with us three and our gear onboard. The draft enabled us to skim over coral with the leeboard up and the steering oar out of the water to avoid having to go round outcrops. Shunting (couple of seconds and almost no effort) meant we could reverse immediately if it got too shallow.

A definite plus in this part of the world. Due to the hull shape it is easy to steer by weight shift with the kite attachment point amidships on the lee deck, opposite the leeboard (actually a weatherboard). Move a person a metre or so and the steering paddle is not required. The hull shape also means that drag is unaffected by shape changes when weight is added.

We were given a 6 kw/8 hp electric outboard and battery in lieu of grant money owed. We fitted it on the tender and with 6 people on board did 5 knots using 1 kw (1.3hp) of power. Impressive enough that both Gav and Trev intend to build smaller versions of the tender.



Leleuvia

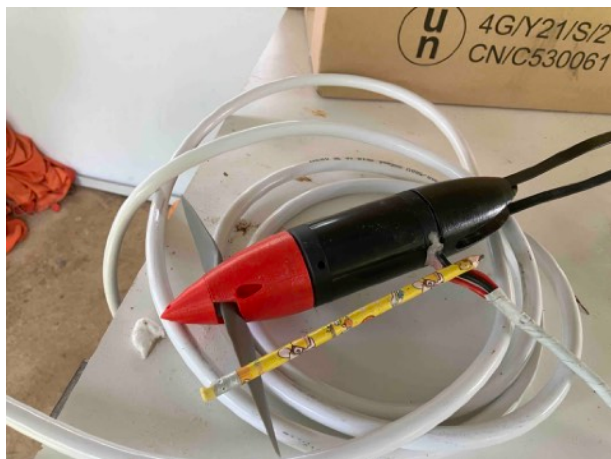
Four of us took it to Leleuvia for lunch, came back in the afternoon, had almost enough battery left to repeat the round trip. Petrol cost and emissions?

Zero. Top speed was 11.2 knots, which implies the prop is a bit fine, we will test some others.

The students took the tender for a blast and managed to whack the hull with the outboard, at full speed (see pic). Due to the multiple bulkheads in the hulls, it didn't sink and because it is a flat panel construction, the fix was a 20 minute job with a backing plate and a couple of layers of glass.

The end result? We are not there yet with a solution to zero emissions small/medium boats, but we are a lot closer than we were with the conventional and wing rigs. The rig works well enough to buy a couple of kites for the cargo proa and see how it goes. There will have to be a lot of disadvantages to outweigh the advantages: no heeling loads, low cost, long life, easy handling (no winches, 2 finger control most of the time), light weight of the kite and mast, no deck gear, easily learnt basics, a simple problem solver mode and sailing with the bows lifted instead of being pushed down.

I'm modifying the cargo proa and will launch it when we have MSAF approval. The mods aren't simple as the boat is set up to do everything from the windward hull. Trev and Gav will be back with the new kites for the next chapter when it is launched .



Gavin had a small waterproof electric motor with a 3D printed housing which he uses to propel his 7m trailer sailer. We mounted it on a piece of wood and used it to push the tender, then dropped it in the water. A floating outboard! This type of motor opens up some interesting possibilities for converting petrol outboards, powering canoes and building our own low cost outboards.



There were a few surplus to requirements solar panels available, so the students put them on the roof of the boat shed, Dels the sparky wired them up and we have Fiji's first solar electric boat recharging station. Not particularly elegant, but it will do the job.

We are organising Boat Master courses for the students and staff so they can take the boats out fishing and snorkeling. An impossibility with the outboard on the 8m CATD fibre due to the cost of fuel.

I spent a couple of pre Xmas days working with the plastic recycling people. Built 2 frisbees (see attached) from plastic bags and scrap dress material. The equipment to process unwashed and unsorted plastic is on it's way from China, we hope to be operational in April. The frisbees are part of the school program planned as the next step after we get set up at CATD.

Last week we attended the award ceremony for the UNDP grant awarded to CATD for a project to

develop mud brick houses, similar to the ones built in Ba in 2005, which were the only buildings to survive cyclone Winston in 2017. One of the people involved in building them is now at CATD. There is potential to use the glass we are crushing as a sand substitute and perhaps a couple of uses of the recycled plastic in the construction of these houses. Interesting stuff.

For those who are curious about CATD and what it is about, have a look at this [video](#).

There are boat building workshops in the pipeline for Matuku Island (Lau group) and Taveuni, both beautiful places. Won't be running the workshops, but intend to visit and have a look around.

In Harryproa developments, [www.harryproa.com](http://www.harryproa.com) is back on line, complete with some stunning new renderings Steinar has been working on. There are now 2, perhaps 3 C50's to be built here, once the Innovation Hub shed is complete. This is an ongoing process, with a lot of disparate elements that need to come together before construction can begin. We are having a great time, with great people in a great place.

If you don't wish to receive these updates, please let me know.

Previous updates can be found at <http://harryproa.com/?p=3788>

More information on Harryproas generally is at <http://harryproa.com/?p=3788>

Discussion is at <https://groups.io/g/HarryProa> and <https://www.facebook.com/Harryproa/>