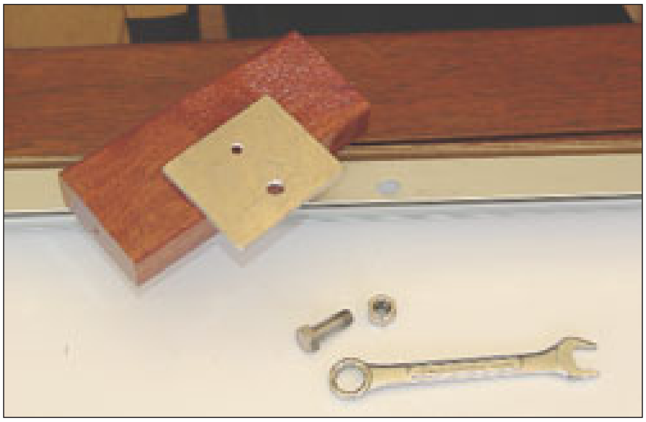
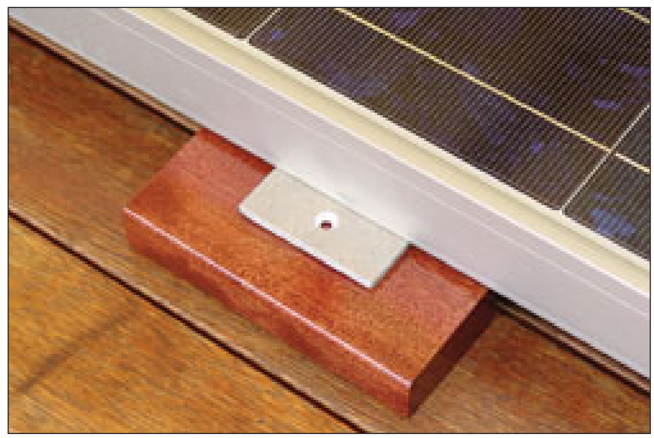


Installing the solar panels is relatively simple. The underside of the frame is pre-drilled, and because the maker's recommend that you don't install the panel (and its all-important electrical controls) hard onto the roof, we prefer to lift it up about 20-25mm so that it sits clear of the roof - and rain or hose water can then pass harmlessly underneath.



Solar Power

- Free, Efficient and Environmentally Friendly!

The F&B Team has enjoyed real success with solar power, running their 110 litre deep freeze entirely on the input of the three solar panels embedded on the roof of *Far-Away*, F&B's 8.2m Honda-powered 'Salty' plate alloy cruiser. In fact, they have been so successful, they decided they could solar power their creek fishin' dory too!

It will come as no surprise to long term readers that we are very passionate about the use of solar power on our boats, whether they are solar panels just for keeping a battery charged through winter, or as back-up to the boat's engine alternator(s). Or, as in *Far-Away's* case, our new Salty 27, as the primary auxiliary 12v power source.

Solar panels are achieving new and exciting levels of efficiency, output and reliability.

Over the last couple of months, we've been settling in the new 8.2m cruiser at the end of the wharf here on the Gold Coast, as we simultaneously tended to the myriad jobs that need to be completed before *Far-Away* is ready to cut its umbilical cord to civilisation.

One of the main jobs has been to establish the power efficiency of the solar panels we've installed, and then marry their output up to the boat's 12-volt electrical system.

As a result of these preliminary trials, we have now upgraded the original 210amp AGM battery to a 255amp model, and completely changed the refrigerator and freezer system from a Waeco evaporator plate system to a more traditional eutectic freezer system, using custom made, heavily insulated freezer chests.

This was primarily because the Waeco system, although good value for money, draws more power than we can generate in a boat that does not have a generator, and will be used away from 240v power for weeks on end.

The Waeco-type evaporator plate refrigerator or freezer systems work very well if you can plug them into the marina's 240-volt power system, or attach it to the mains power source on your jetty at home, but it simply doesn't work if the boat has to leave the 240v power supply for more than 4 or 5 days. Without 240v power to drive a battery charger to keep the 'house' batteries topped up, the power consumption needed to run either (or both) the Waeco refrigerator or freezer will drain the biggest batteries in a matter of days – unless, I stress, the engines are running for many hours, and/or the boat is plugged back in to a 240V power source, to charge it all up again.

Alternator Power Drawbacks

After weeks of trials, we concluded that between the Honda 150hp 4-stroke outboard's phenomenal alternator output and the solar panels, we still couldn't generate enough electricity from the combination without using the Hondas for too long.

Anybody building or planning to build a new boat needs to understand this point really carefully.

Our two Honda 150's were approved by Honda to run at 1200 r/min 24/7 if necessary. Because they are such capable 4-stroke engines, running at trolling or low speeds, all day all night, makes no difference to them. With the two engines running at 1200 r/min, it is theoretically possible for us to generate a massive 70amps, and at face value, that would seem to be more than enough to charge the big AGM 210amp house battery in short order.

But this is the part most people (including us, if the truth be known) haven't really taken on board.

Yes, the Hondas will generate this much surplus power (easily) but as we quickly discovered, even with one of the world's best brands of AGM batteries, the amount of electricity we could put back into that battery was restricted to such an extent that we could only put in 40 - 50 amps, before the battery's ability to absorb the inbound charge would rapidly taper off to a progressively slower absorption rate.

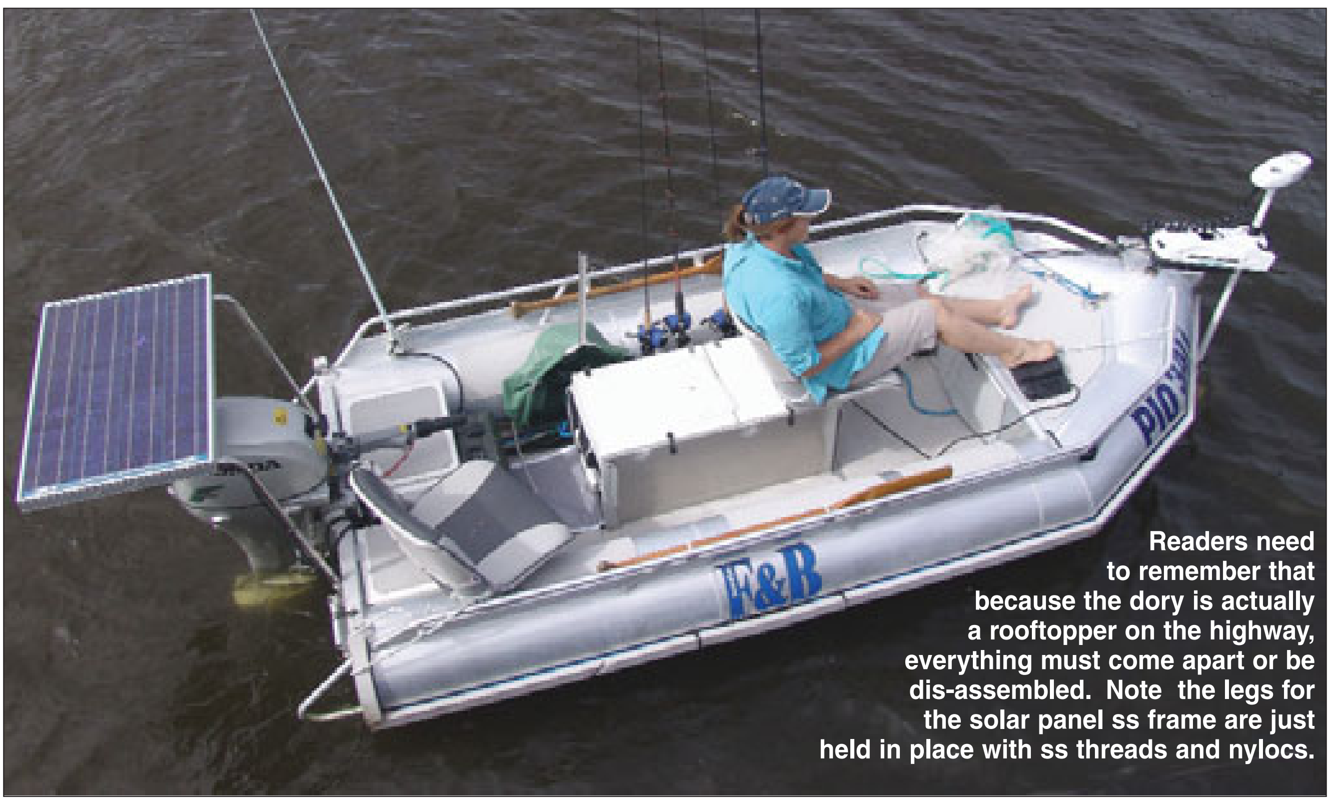
In fact, the AGM battery would only accept around 40 amps when it was almost discharged ie, it was down to a capacity of about 80 or 90 amps out of its original 210. At this point, the AGM battery would cop 40-50 amps very quickly, but in the second hour,

the 'acceptance rate' would fall to around 20-25 amps, and in the third hour, drop down to about 10-15 amps.

We quickly realised that running the second Honda 150 was a total waste of time and precious fuel, so we've developed a new strategy now.

This new approach recognises that in fact, it's better to operate the battery between (say) its rated at 50-80% capacity because at that point it will accept the charge fairly quickly,

So far, the location of the panel 'out the back' and over the outboard seems to work quite well - although we'll wait until we have a serious fish running around the back before we get too excited. Once again, we used high rating 50 amp Anderson clips to join everything together as required.



Readers need to remember that because the dory is actually a rooftopper on the highway, everything must come apart or be dis-assembled. Note the legs for the solar panel ss frame are just held in place with ss threads and nylocs.

whereas to top it up from its 80% level, right through to 100% full (210 amps) capacity, does take hours using the engines' alternators or solar power.

Now, here's the rub – we, like many other consumers actually purchased the Hondas for this wonderful alternator capacity, but it transpires that it needs to be qualified as to how it can best be used.

In terms of battery charging, it needs to be thought about very carefully because it's not just as simple as dividing the battery capacity by the alternator's ability to produce amps.

We believe this is a particularly significant point to take onboard when you are evaluating these new big 4-stroke outboards. All the outboard companies make such a song and dance about the "new, improved" alternator capacity, and they'll state quite clearly that they will easily charge batteries and run the ship's electrical systems – they will too, *whilst the engines are running*.

Cruising Issues: HP vs Amps

However, if you're in a cruising environment as distinct from a gamefishing world, the application of the 12-volt power is somewhat different to running an engine(s) all day at trolling speeds wide offshore. Sure, these engines will then power up virtually any electronic equipment you have onboard, as well as the fridge and freezer and in fact, the more load you apply to the ship's house battery, the better the whole system will perform.

Where it all goes a bit pear-shaped though, is when you don't want to run the engines - or you can't afford to use that much fuel when fuel is a precious resource that controls the range of the craft.

Okay, we know too that the big Hondas will run all day for around 3.5 L/ph at around 1,200 r/min - which sounds like absolutely bugger all, until you do the sums.

At 4 hours a day, that is 14 litres - and over a week, that's 98 litres of fuel being used to produce 'X' amps of 12-volt power.

It's not only costly, it's a very inefficient use of fuel - and mark you, this is only when you're using ***one of the engines for 2 x 2 hour battery charging sessions a day!*** If you're out in the bush for 3 weeks, you could blow 300 litres of fuel very quickly, just running one of the engines four hours a day to charge the batteries.

Now obviously, if the boat is being used every day, this consumption can be made part of the boat's management system ie, if you're moving up the coast and will be running for 2 or 3 hours each day, clearly this is the time when you'll get a "free hit" from the alternators because you're going to be running the boat anyway.

Where we got into trouble was when we wanted to stay in one place for a week, and work from that one place with the dory. And let's face it, if you've got the anchor(s) down in a beaut anchorage with the boat nicely balanced fore and aft in the main channel of a reasonable tight northern creek or river, then it's an absolute pain in the arse if you've got to up anchor(s) and move off for 2 or 3 hours to run the boat somewhere to find another anchorage and/or come back to the same anchorage.

So once the boat's settled down, it tends to stay there - and that's when we turned to solar panels.

Initially, we had 2 solar panels on *Far-Away*. The first was the big 125 watt job (see pic P.59) assisted by a smaller 85 watt panel which would have been 125 too if we'd had enough space left on the roof to install it.

This is a critical piece of the solar panel set-up - the regulator. This device monitors exactly what is going into the battery(s) and stops supply when the battery is chocker ie, it makes sure the battery doesn't 'cook' itself from overcharging.

Time Out: *The moral here first off is critical - before you paint any platey, or plant handrails on the roof of a glass boat, sit down and think very carefully about where you're going to put the solar panels - because you need quite a lot of space for the large panels.*

But with our two solar panels, we looked forward to getting a theoretical capacity of 17 amps.

(Note, to get the theoretical figure in a 12 volt system, divide the solar panels' wattage by 12 ie, a 120 watt panel could produce (in theory) 10amps).

In practice, we've found that you get about 70% of the theoretical maximum down into your house or ship's starting batteries.

In other words, in this situation, the theoretical capacity of our 2 panels was 17.08 amps (120+85= 205 divided by 12 = 17.08) but in practice we only budgeted on putting in 12 amps (11.95 amps or 70%, specifically) from the 2 panels.

This doesn't sound like very much, but when you multiply it by 6, 7 or 8 hours a day, it very quickly adds up to a rather useful capacity.

On a nice sunny day, we normally put in around 80-90amps a day, and that's (as we've discovered) more than enough to run our special new eutectic freezer system forever more - because it only draws about 40 amps per 24 hour period - but remember, that's an exceptionally low power draw.

Remember too, the solar panel will only work for 6-8 hours a day at full noise, because as the sun rises at dawn and then arcs down towards sunset, the panels' charging rate rises and subsequently drops away very quickly.

Up north though, you can usually figure on getting 6-8 hours a day quite easily and in summer that can go right up to 10 hours without too much trouble.

Charging Management

It all becomes a fascinating balancing act. What we had to do was work out how much Far-Away would use sitting at anchorage for a 24 hour period - and that means sitting down with a calculator and a pen, and working out exactly how much electricity the boat will need.

Having worked that out, it then requires a management strategy that goes along the lines of "If we're going to run the engines in the morning and we can't really use the second Honda's output charging the AGM house battery, then that's the time we should use their capacity to run the desalinator - which needs to go for about 2 hours a day, (@22 amps x 2hrs =44 amps) to produce about 100-120 litres of new, fresh water in the tank . . ”

“Similarly, it makes sense that the Electrasan toilet system is used at this point too, and anything else that needs to be done that uses quite a bit of electricity - all this should take place during the engine running sessions in the morning or in the evening when we have excess electricity coming in from the Hondas.”

It's critical that you maximise the use of the alternator's efficiency when it has to be budgeted up against the amount of petrol being used.

Interesting shot of the dory *(“Over The Hill”)* and *Far-Away* with the trio of Honda 4-strokes. F&B has spent a great deal of time researching how much solar power we can generate in both craft, to avoid the need for a conventional gen-set. The trouble with a gen set, is that they all use at least 2.0 - 2.5 l/ph, and have to run *a minimum* 4-6 hours *a day*.
Over a couple of weeks, this can amount to an amazing (and costly) amount of fuel, plus it adds significant weight, extra tankage, fuel lines, servicing costs - and it’s noisy!
By comparison, if our solar panels can provide the big shot of 12v power we need (backed-up on demand by the Honda’s alternators) we save heaps of fuel, weight - and it’s all free, silent, and works whilst we are away from the boat, or on the highway.

Dory Issues

About this time, we started getting a bit worried about the amount of electricity we needed, especially when we factored in the dory's Minn Kota 12v electric outboard.

Our experience in the past has shown us that the Minn Kotas are actually quite efficient, past experience suggesting they average around 6-8 amps when we’re trolling in northern rivers, creeks and drains, with most days using 15-20 amps in a morning session and similarly in the afternoon.

We use an 85 amp deep cycle Century battery in the dory, so it only takes a day or two to get that very flat - at which point in time (with *Dusty Rover*), we'd plug it into Dusty's electrical system and it would immediately "level" the electricity from Dusty's house battery to the dory battery ie, if the dory needed 35-40 amps to top it up, it would take it straight out of Dusty's system.

That was all well and good to a point, but we knew that if that kept up, Dusty would ultimately run out of electricity too.

It didn’t matter so much then, because we rarely took Dusty more than 3 or 4 days away from a marina or 240-volt power, at which point in time the batteries were all charged up again - over and above the alternator's input from the Yamaha diesel.

In *Far-Away* though, it's all a bit different. We're very power conscious because there will be many times when we will be so far away from civilization, 240-volt power is not an option - for several weeks at a time.

It became obvious before Christmas (05) that if we were draining another 30-40 amps off *Far-Away's* 210amp house battery each day for the dory, this would be hard to replace on top of the capacity we needed to run the boat itself.

At this point we started looking at making the dory self-sufficient in 12v power, too.

It must be possible, we mused, because we can get 6 amps off the little Honda alternator in the Honda 20, and that will give us a bit of a bonus in terms of running from the mothership to the fishing ground. As the *modus*

operandi is always to use the Honda to drive the boat to the fishing ground, this was quite practical. Once in situ, we drop the Minn Kota down and start using the electric outboard.

Although we'd discussed using solar power on our dory back in the Stessl dory / *Dusty Rover* days, the concept had never gone much further than a discussion at the end of the day over a cold VB as the sun went down. . .

So this time, late in 2005, we started investigating the proposition seriously. How much power did the Minn Kota use? Could we achieve par ie, power in equals power out, with a solar panel?

The more we thought about it, the more intrigued we became, because one of the ironies here is that most of our fishing is done fairly early in the morning or later in the day (depending on tides) but even if the tide was rising during the day and that was the period we wanted to fish, then there was no reason why the solar panel couldn't be charging its little panel off big time whilst we fished.

Or alternatively, on the days when we fished early in the morning and returned to the mothership about 10am, the dory could sit there behind the mothership, basking in the warm northern sun for hours, before being required for service again later in the day.

We did more sums. If we ran the Honda for a total of an hour coming and going twice, (suggesting 4 x 15 minute trips) and then put in (say) 5 hours of the 50 watt solar panel's theoretical 4.5amps x 70% ie, 2.9amps, then we'd end up with around 18amps of solar power coming into the dory's battery to offset what we guestimated would be about 2 x 3 hour sessions at 6-8 amps, which equals (roughly) 35-45 amps.

We accept that this is all theoretical at this stage, but the fact remains that you don't use the electric absolutely non stop all the time, because you're forever stopping and starting, coasting, drifting or working along with the tide on very low settings.

As a protocol, we almost never use the Minn Kota above the 4th or 5th power setting (with a fresh battery) because it just sucks too much power out, and if you're going to go anywhere of consequence, it's much easier, faster and more efficient to just reach over and pull the starter rope on the Honda, and go there under real power.

> **" . . . we're getting close to achieving real parity of power in and power out, from a combination of the solar panels and the powerful Honda alternators . "**

So again, there's a bit of a management issue involved here.

In practice, we've discovered that although the Minn Kota's using a bit more than we thought, (it seems to be running up to about 5-7 amps** from what we can tell here on the Gold Coast) the fact remains that it looks like we can get fairly close to 'par' **(where power out = power in)** with this new system, *averaged out* over the whole day, seven days a week ie, we're really maximising the time the dory ***isn't*** being used.

*****Time Out:** I can't stress enough that the results we're getting from the Minn Kota rely upon the skipper using his brains about the performance of the Minn Kota electric. Pushed up to their maximum setting ("#10") these electrics use up to 40 amps, working hard; the difference between the throttle settings is simply staggering. Now we've got the BEP "shunt" set-up on the dory, we'll make up a graph to show readers what is going on down in the business end of the Minn Kota.*

In an environment where literally every amp counts, this could be a breakthrough of very significant proportions for us, not to mention thousands of our readers who are forever struggling to keep up the capacity on their Minn Kota's or electric outboards and are having to carry bigger and potentially more dangerous batteries than is really warranted for the task, let alone the size of the boat.

Over the next couple of months, we're going to monitor the situation very closely, and we'll come back with a working analysis of the power consumption vs speed vs time capacity in the not too distant future as a result of using the systems in the field.

Adding A Third Panel

As a footnote to this story, as you can see in the photographs, we've now added a third panel to *Far-Away's* roof so we're now generating up to 18-19 amps of solar power off the roof for 6 or 7 hours of the day – plus a bit more on the fringes of the main solar "cooking" hours.

Okay, so here's wrap. We have now

- Increased the capacity of our house battery from 210 to 255 amps,
- Added the third (125w) solar panel
- Divorced the dory from the ship's system and installed its own, removable 50 watt solar panel
- Replaced the conventional Waeco evaporator plate fridge and freezer systems with high insulation, custom eutectic systems.

We now believe we're getting close to achieving real parity of power in and power out, from a combination of the solar panels and the powerful Honda alternators.

We acknowledge the Honda alternators have their limitations in terms of charging the house battery, but there's no doubt their capacity is prodigious and very useful when it comes to providing a quick, 50-60amp boost to power up the AGM battery if it's run down after a week or so of constant work.

To do that more efficiently, we upgraded the AGM battery's capacity from 210 to 255 amps, so we could do most of our re-charging in the faster charging 60-80% range (between 150-210 amps) of this big, (72 kg) 255 amp battery, and let the solar panels top it right up to 100% when they can.

As well, the third panel is basically there to pick up any 'leakage' from our system, or to put it another way, to make-up for any cock-ups we might have made in our calculations.

All in all it's been a wonderful experience learning how to work with the solar panels - and we're going to monitor them very closely to learn more about the best use of this wonderful energy source.

F&B