



## Powerfilm PT7.2-150 solar cell

**Select Solar customer Rob Hague explains how he has added power to his Quest pedal-powered vehicle using a Powerfilm PT7.2-150 low voltage solar module.**

“The Quest is a pedal-powered velomobile - an enclosed, head-out faired tricycle. The machine is designed to enable high-speed cycle commuting and touring with the level of weather protection expected by motorised vehicle users. I find that on my 6 mile commute using this vehicle my 'best' times are around 1 minute slower than the best 'driving' times although average times tend to be the same and the Quest is often faster because, as a pedal cycle, it is allowed to pass slow or stationary motor traffic. Vehicle details here: <http://en.velomobiel.nl/quest/>

I bought my Quest new. It was supplied with a 6 volt, 3Amp-Hour Nickel-metal-hydride battery with fitted wiring to power the built-in headlight, tail light, indicators and horn. This just about provided enough power to run the lighting on my commute for a week. I tend to run the headlight/tail lamp full time when commuting, as per motor cycle regulations, in order to optimise visibility of the machine.

I initially added one, and then upgraded to two PT7.2-150 (200mA at 7.2V) panels, a roughly A4-sized encapsulated PowerFilm photovoltaic solar panel. These panels are contained within a sealed non-stick plastic envelope that provides physical and UV protection to the panel - ideal for exterior full-time use on the outside of a pedal cycle.



The non-stick plastic does present the problem of how to attach the panels. My first attempt was using retro-reflective vinyl tape which I already had to hand for adding to the cycle for night use. After a year of use the original application of this tape is still holding the panel securely and I have not needed to rework it.

As I was reluctant to make holes in the vehicle bodywork (because of the risk of generating stress cracks from the holes and the risk of weakening the overall structure), I needed an alternative approach to hook up the panels. This was achieved using 5mm self adhesive copper tape. The PowerFilm tabs soldered to the tape, and the tape runs along the bodywork into the inside of the vehicle. The copper tape was weather sealed using the same vinyl tape.

Inside the vehicle I fitted crimped plugs to the end of the tape to enable connections to be made. I built a small circuit containing a diode to prevent reverse current flow through the panel (discharging of the battery through the pv panel - potentially trashing the Powerfoil panel) and a small low-power LED (around 2mA) and circuitry to indicate when electricity was flowing. I wanted

this not only to monitor when the panel was charging, but also to allow me to monitor the system over time in case of failures, wire breakages, etc. as in case of any such failure the LED would no longer light and I would know fault investigation was necessary ahead of simply finding my battery running flat. The reverse flow diode caused a 0.5volt voltage drop from the panel supply but this was expected and, indeed, helpful - with this in mind the PowerFilm panel matched charging voltage and current to my application no additional charge control circuitry necessary. The information necessary to assemble these very basic electronics was found here: <http://www.reuk.co.uk/electronics.htm>. After testing I used some Loctite Repair Express, which mixes to a bluetac-like material, can be worked for 5 minutes or so like modelling clay and then sets hard, to seal my electronics from the weather and to prevent any vibration damage. This was then stuck to the inside of the bodywork. This system was then connected directly to the existing battery system.

My Quest is stored in the garage at home and is left outdoors at work during the day. The single panel proved to be sufficient, even in winter, to keep the battery charged from this daytime exposure and allow normal use of all of the vehicle electrics when commuting.

After the success of the initial installation I decided to improve on it. I use the Quest not only for local trips but for longer journeys and planned on using it for camping/touring. On such trips I use a mobile phone and a GPS unit. Keeping these units powered can be a challenge and there are self-contained solar chargers available but I already had a suitable power source working and thought the opportunities to leave a self-contained system in the sun for several hours a day might be thin on the ground. Again using information from <http://www.reuk.co.uk/electronics.htm> I built a voltage regulator outputting 5v to a mini-USB connector. In order to avoid this flattening my battery I added a second PowerFilm panel to the installation.



This equipment has worked so well that I am looking to implement a similar setup on my next vehicle ready for a long distance tour around the coast of Britain - see <http://wrhvp.com/glydearoundbritain/glydebritain.html>. I anticipate again using PowerFilm panels but this time I may design my system around charging a set of 4 AA batteries which, in turn, can recharge my USB devices, effectively integrating a system like <http://www.selectsolar.co.uk/pics/folding-solar-panel-USB.php> into my vehicle. The reason for this approach rather than charging the equipment directly from the solar cells is that it allows optimal gentle steady-state charging of the delicate Li-ion batteries without risking damaging them. Intermediate Ni-MH AA batteries are cheaper to replace and better able to cope with the intermittent charging that the photovoltaic panels can provide on a moving vehicle.

Rob Hague, Westcountry Recumbents  
<http://wrhvp.com/>

*Text is copyright Rob Hague. No part of this text may be reproduced or copied without written permission.*