Wheel motors − too good to be true?

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The following is from a "Voltage Forum":
http://tinyurl.com/ogvr7

I checked the company website:
http://pmlflightlink.com/motors/wheelmotors.html

and found specs for their wheelmotors which seem reasonable enough
http://pmlflightlink.com/pdfs/eWheel.pdf

However, the power specs for the car seem way off base for any of the listed wheel motors or any known technology, AFAIK. Particularly, the assertion of 160 bhp per wheel. The torque of 750 N−m (552 ft−lb) is close to the advertised maximum spec of 640 (160 cont), but the power is 14.4 kW, or about 20 HP, at 900 RPM. I think somebody mistook the 160 Newton torque for bhp, and ran crazy with it! Do you think the acceleration spec is believable? An actual total torque of 2200 ft−lb for a 3600 lb vehicle, with 24" dia tires, would provide about 0.7 G, and 0−60 in about 3.5 seconds.

So, aside from the overblown HP hoopla, this still looks like an impressive vehicle. It's a shame they still feel a need to design and advertise so much on the basis of raw HP and amusement park acceleration. It looks like they could have made a still impressive car with half the power and perhaps 120 MPG, which would impress me a lot more than burning rubber.

Paul

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June 29, 2006

Dear Jim,

BRITISH MOTOR SHOW − 20TH TO 30TH JULY 2006 EXCEL CENTRE LONDON

On behalf of PML Flightlink, I would like to invite you to visit us at the upcoming British Motor Show at the Excel Centre, London. It runs from the 20th − 30th July. Please take a look at the website for more information www.britishmotorshow.co.uk. We will be on stand 270.

PML will be exhibiting the new Super Mini QED, produced to demonstrate the EW series wheel motors and generator technology co−ordinated on the vehicle as a Quad Electric Drive system, together with additional new technology developed in tandem, including Energy Management Systems and In Car touch−screen interfaces.

Vital Statistics:

0 − 60 in 4.5 seconds!
Approx. 80mpg!
Approx. 150mph top speed!
No brakes?!

I have attached a report (see below) on the new Super Mini QED specifications − it should be an interesting read.

The new Super Mini QED from PML demonstrates the future of CLEAN transportation cleverly packaged in a stylish and desirable vehicle.

QED − Quod Erat Demonstrandum

Please let me know if you can make it. It would be great to see you there.

Best regards,
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Super Mini QED − Quad Electric Drive

For the past 4 years PML has been quietly working on something of a literal revolution. Its QED technology is set to move the Electric/Hybrid vehicle market into Top Gear! With some notable car manufacturers releasing various embodiments of so called "Hybrid Technology" the general public is becoming more aware − at least of the terms, and to some extent, of the technology itself.

Of course the term "Hybrid" has many levels of stratification in it's realisation, starting with the "switch off the engine if the vehicle

remains stationary for more than a set time" through to so called "Parallel Hybrids" which drive the wheels via the engine and gearbox as well as an electric motor powered by a battery, along with a generator fitted to the engine.

The problem with all the above remains the poor efficiency of the internal combustion engine, which even on a good day returns no more than 20% of the fuel it burns as usable mechanical energy to move the vehicle. Although IC engines can have efficiencies of up to 40% this is rarely, if ever, realised in practice due to the continuously varying loads and speeds involved in a typical "real life" journey.

Battery technology is improving year by year and there are some interesting options which look promising in the next 5 to 10 years. Today however, the battery technology is still the limiting factor in realising a full utility vehicle. Do not despair; there are ways to manage this!

It seems today that anyone with an environmental conscience has the limited choice of a Toyota Prius or a Honda Civic! Of course there are other vehicles on the market but they all require substantial sacrifice of motoring pleasure and utility if your Green conscience is to be placated.

Well this does not have to be the case any longer. The PML solution, which can be seen at the British Motor Show at the Excel centre, London from 18th July this year, strips away all of the misconceptions about electric hybrid vehicles to showcase a truly awesome car.

Take a standard BMW Mini One:

Discard the engine, the disc brakes, the wheels, and the gearbox. Add instead four electric wheels, a lithium polymer battery, a large "super capacitor", a very small IC engine with generator (so small it fits alongside the spare wheel!), an energy management system and a sexy in−car display module. Give the vehicle 3 modes of operation, Eco mode for in town/city frequent start−stop operation, Normal mode for daily commuting and equivalent ICE car operation and Sport mode for all the bells and whistles you would expect from a super car.

Result: Super Mini QED

0 − 60mph 4.5sec (Mini Cooper S around 7.5sec)
Top speed (where allowed) approx. 150mph
Electric only operation time 4 − 5 hours commute at 50mph or less
Fuel economy approx. 80mpg (when powered by the generator)
No loss of passenger or boot space
Weight distribution and handling as original vehicle
3 driving modes Eco, Normal and Sport

"Look no brakes!"

All braking is performed by the wheel motors acting as very efficient

electrical generators which return almost all of the energy back to the battery system. The beauty of this system is that unlike a conventional vehicle your green conscience can be quite content even when accelerating hard, since you are assured of collecting most of this expended energy should you have to slow down quickly!

ABS − forget that pulsating foot!

Because the wheels are high performance motors, ABS comes as a standard function built into each wheel's software. Now anti−skid can also be applied to acceleration since the motor can smoothly control torque delivery to/from the road in both cases. Slamming your foot to the floor results in controlled maximum torque, giving the shortest possible stopping or acceleration time.

Clever wheels!

No need for crude differential gears to share power between left and right sides. The wheels are in constant communication with each other deciding 1000 times each second how much torque share is optimum for the current driving conditions. Should one wheel detect a slippery surface and take appropriate anti−skid actions, the other wheels are aware of this instantly and adopt an appropriate compensating strategy to keep the vehicle as stable as possible.

Brake horsepower? − schmorsepower!

Each wheel develops 160bhp!! Yes that is correct, 640bhp in total! The original Mini One develops less than 100bhp with an engine that weighs nearly double the weight of the four electric wheels! Apart from wheel bearings there are no wearing parts in the electric wheels; this means the horsepower stays for the life of the vehicle − and beyond!

Charging? − schmarging!

As the battery level reduces, the rear mounted engine/generator starts to automatically top up the battery. So when you arrive at your destination you can simply park the vehicle knowing that when you return the battery will be replenished! Alternatively you can take advantage of lower cost mains electricity and plug in to recharge. Driving along the motorway to visit friends in Manchester − no need to worry about battery capacity or how to recharge. As the level falls the generator is started to sustain an average speed of 60 − 70mph with no further battery depletion.

Super capacitor − super acceleration!

Capacitors are used to store electrical energy. The difference between batteries and capacitors is that capacitors can release/absorb their energy 10 times faster than a battery. For acceleration or power boost at higher speeds the capacitor enables nitro−like performance, more than doubling the power from the battery during these events. Very efficient energy recovery

means next to nothing is wasted during stop start city travel. The capacitors also allow the battery to have an extended life by smoothing out any peak loads.

Energy flow management

A significant key to super performance is optimum energy management. Continuously deciding where energy flows should be − battery, super capacitor, generator, wheels. By clever optimisation of the flows, best use can be made of available reserves, allowing a fun driving experience whilst protecting the planet.

Small engine and generator

The IC engine weighs a mere 15kg (less than 1/10th of the original Mini One engine) and delivers 15kw. A high efficiency electrical generator is fitted to the engine to provide power when the battery depletion level demands. The key point is the engine is run at a continuous speed and load − which results in optimum efficiency fuel conversion. After delivering the energy to the battery system the mile equivalent translates to around 80mpg!

In−car display

With all this advanced technology the driver needs to have clear and complete information presented to him. The in−car display module provides the latest touch screen technology with intuitive display and scroll options. Showing available mileage subdivided by battery and fuel along with boost status, the display gives comprehensive information. Of course the display shows speed and warning functions, but further it is GPRS enabled allowing:

Remote diagnosis of any fault to allow the "AA" man to come prepared
Auto tracking of speed limits (optional!)
Auto management of generator to prevent inner city operation
History storage and system configuration interface.

PLUS:

Each of the 3 driving modes is selectable by a single touch of the in−car display. Imagine starting your journey in the city in Eco mode then selecting Normal mode as you reach the suburbs, and finally Sport mode as you hit the open road. There is no other way to make your journey! What more can be said?

Quad Quod
Electric Erat
Drive Demonstrandum

Summary:

Look No Brakes

High power wheel hub motors
Dual circuit operation
High reliability electronics
Anti skid braking and accelerating
Torque share/traction control

High Power Wheels
160 bhp (120kw) each wheel = 640bhp total
750Nm per wheel = 3000Nm total braking/acceleration torque
HI − Pa Drive technology

Provides world leading:
− Power to weight
− Reliability
− Safety
− Efficiency

Hand brake parking included in rear wheels

TMS − Torque Management system
Full ABS functionality − but smooth!
Anti skid acceleration control
Optimum differential and torque share
Full traction control
All functions smooth and fast!

EFM − Energy Flow Management
Manages energy flows between battery, capacitor, generator and wheels
Provides torque boost at high speeds for rapid overtaking
Optimises energy use/flows
Allows top speed of around 150mph

ICD − In Car display
Immediate selection of driving mode:
Eco
Normal
Sport

Provides full driver information service:
Speed
Range
Performance
Status
Energy flow map

Reports warnings of:
Low battery
Extreme temperatures
Other out of limit warnings

Future option to link to GPRS allows:

Journey / energy reserve matching
Prediction of journey radius available
Automatic speed limit control (optional!)
Driving license optimised speed constraints
Remote diagnosis of any system fault conditions
Auto reporting of breakdowns
Auto location for attending engineer

REG − Range Extending Generator
15kw continuous power allows normal cruising with zero battery impact
Optimised running conditions enable approx. 80mpg equivalent fuel consumption
Compact unit weighs less than 40kg total
Operates automatically to charge battery when level drops to 50%

Battery system
21kw hr Lithium polymer
Over 2000 charge/discharge cycles to 80% dod = 10yr estimated useful life

Super Mini QED
High performance series hybrid
Full four wheel electric drive + range extending generator
No intrusion into base vehicle utility space
Weight distribution and handling same as base vehicle
No mechanical dynamic brakes
No gears or other mechanical transmission
Super high performance wheel hub drives
Dynamic torque distribution for skid free braking and acceleration
Top speed approx. 150mph
0 − 60mph 4.5sec

Super capacitors give boosted top end performance and optimum energy management

Who are PML?

PML (originally Printed Motors Limited) invented and patented the printed armature motor some 40 years ago. The printed armature motor was the first "pancake" format motor and led the world in compact high performance brushed motors. In the last 4 years, under private ownership, PML has concentrated on the pancake format brushless electric traction "wheel motor" development and wind turbine generators. This year marks the launch of several new products pushing forward direct (gearless) motor drive systems.

The mini project has been undertaken to demonstrate the super high performance now possible from PML Hi − Pa drive and QED technology lead. With very high efficiency, light weight and extreme levels of reliability PML Wheel drive systems are suited to harsh environments needing extreme levels of safety.

Set to take off in a big way, PML is a British company investing heavily in R&D to take advantage of the benefits of super efficiency lightweight wheel motor drive systems. In a global economic climate looking for steep changes in transport efficiency improvements, PML is well positioned to take the technological lead.

(Much of the data above is predicted and is dependent upon the terrain, weather conditions, driving style etc. PML has used its best endeavours to present accurate information, but accepts no liability for any errors and/or omissions).

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