Logbook

18th March

- I finished my design planning and wrote my first design brief.

24th March

- I completed the first stage of my general research. In this first stage, I was trying to find out what methods are being used today to turn reasources (reasources that you are likly to find when you go camping out in the bush) into electricity. The methods that I found where
  - wind turbines - resorce being used is wind
  - solor panals - resource being used is light rays from the sun
  - steam engines - resorce being used is water and wood.
  - hydro turbines - resource being used is water (flowing/falling water)

Also from this first stage of general research I have realised that the method my client chooses for me to develop will be using renewable resources I so there should

25 May

- I completed the second stage of my general research and with reference to my key factors, I chose the wind turbine as the most practical method to produce power to saite my clients needs most effectively.

~ 27 May

- I went to see Roger at the Battery Warhouse. I explained to him that I am intending to build a wind turbine to charge a laptop. I told him how I was at this stage expecting to do it and he agreed that it was doable. He explained to me mainly what he would expect the electrics and battries to be like. he drew me few small sketches. Roger told me some information on the cheapest battary that would fit my purpose. Roger also gave me a better understanding of Watts, Amps and Volts, wich included the water analogy and how each one relates to each other.

5 June

- I started to collect a few different electricity producing generators.
- The first one I tryied to find was a car altenator. I phoned Grant who owns Auto world, an auto mechanical workshop. I asked him if he had an old car altenator that he did not want. He had a mitsibishi altenator that he did not need and so he gave it to me.

6 June 2008

Knowing as soon as I picked it up that it was going to make the whole sgstem (including battery) majorly over my weight specification, I desided to test the voltage it produced anyway. At first, I just rnected the Voltmeter across the altenator and hand spun the altenator shaft. With nothing happening, I consulted the Auto teacher, Mr Jones, and asked for some advice. He informed me that car altenators have to conected to 12V before they can start producing any V as they only containe electromagnets. He drew me a circuit diagram explaining how the battery and altenator must be connected to each other.

7 June 2008

With this new knowledge, I conected a 12V power pack to the alterator, following the circuit diagram. Then I put the voltmeter across the altenator and spun the shaft by hand. It did produce a small amount of voltage. After another consultation with Mr Jones, he informed me that car altenators only efficiently produce good (large) amounts of voltage at extremely high r.p.m in the range of about 1000 or more r.p.m. From my research into small wind turbines, their rotors spin in the range of 200-350 r.p.m So the fact that car alternators are very heavy and only produce V at an R.P.M much higher than I would be able to design my clients wind turbines rotor to spin at, car altenators are clearly not suitable for my clients issue.

I, just for research purposes, did try to spin the altenators axle faster by wraping thin cable around the pully wheel attached to the end of the alterators axle, and then pulling it. getting fairly high r.p.m guestimatly 50-60 R.P.M but still poor V output.

10 June 2008

The second electricity producing device I tryed to find was a scooter alternator, as they would be a lot smaller/lighter than car alternators and as scooters do not go as fast as cars, the may produce a good amount of voltage at a much lower r.p.m. After completing some research on scooter alternators, I found out that they where permiment magnet alternators and that the alternator flywheel (containing magnets), is attached directly to the crank shaft. The stator which is secured firmly and consists of the coil of wire. The flywheel which is like a cilydrical container and on the inside ed - the magnets are secured. The coil of wire which remains stationary (stator) is held just inside the spining flywheel. I then tryed to find some place that had an old scooter or motorbike "stator and flywheel (if that could some use on). I phoned G.P Honda, Bike Force and Strada and all three had no spare stator and flywheel that they could give me. One shop did have an old scooter motor but they would only sell is to me for $100 which is way out of my price range.

20 June 2008

I tryed another few places which were likely to have an old scooter or motorbike flywheel and stator that they could give me for testing. I tryed, Bay City motorcycles, Road and Sport motorcycles Chris Mitchell Motorcycles which all had nothing for me. Determind to find one, I carryed on ringing places and then finally I phoned Adrenglin motorcycles and they told me to come in the next day because they were sure they would have something they could give me.

21 June 2008

I went into Adrenglin Motorcycles and they gave me a stator and flywheel from a scooter and it was not in too bader condition.

21 June 2008

I started some Voltage tests on the scooter altenator. As there were two seperate pieces to this altenator, I decided to use the metal lathe to spin the flywheel whilst the tool stock held the stator stationary and just inside the flywheel. I had to weld up a bracket that the tool stock could hold onto. And the bolt the stator to the bracket.

With a fair amount of fiddling around ~~with~~ in height adjustment of the stator, I did finally perfect it. I definetly attand more promising results than the car alternator. But again due to the weight of the flywheel (maybe could be decreased by lathinging it down) and the still quite heigh r.p.m before a usable voltage is produced (1000rpm) I thought there must be a better way.

28 June 2008

Today I had my first consaltation with my Engineer. We disgussed a few issues and he pointed out things making sure that I looked at problems from all angles

5 July

- I started researching other methods of generating V at fairly low r.p.m. The first method that I found from my research to generate voltage at low r.p.m was to use a stepper motor. Also from my research I looked into how steppers work. They are mul ? ? ?
- Found out that printers contain them
- I went to the Toner shop to get a printer tests on steppers

Research into motors

6 July 2008

- Other type of generating method found in printer, servo motor. Research into servo motors

More days of Research and Testing V on different types of motors and

8 July 2008

- I organised to see a mechanical engineer (Brian Jackson) every week for advice and help and today was my first meating with him. I basically told him about my clients issue (charging a laptop, and a light, cellpone, G.P.S whilst out in bush camping) and what I had reaserched to be the best way of solving the issue. He seemed to think it was definetly possible and through a lot of suggestions and things to cosider at me. The main advice he gave me though was to start by finding out what size batter will be able to change the laptop battery. This I thought was going to be a key in the progress of my design as it would give me something to work with. He also told me to be carefull during designing as the whole system could be made extremely complicated very quickly and eisily. He and I both agreed that making the whole system similar to a car alternator / battery / cigarete lighter would ensure that the project remains at a still hard but more acheivable level.

10 July 2008

- I went back to see Roger at the Battery Warehouse. This time I took a picture of the actual laptop Battery (10.8V, 5Ah and asked him what capacity would a 12V battery need to be in order to fully charge this laptop battery once. He suggested/thought a 12V, 12Ah battery would do the trick.

21 July 2008

- Another meeting with mechanical engineer, Brian Jackson exposed the facts that actually charging the turbines' battery and regulating Voltage going into battery is now going to require some research. Another issue brought up that will need to be found out is will the 12V 12Ah battery when nearly empty, drop bellow the minimum input voltage of the laptop cigarette lighter charger.

23 July 2008

I found out that when the battery (storage) is nearly flat, I will not drop bellow the minimum input voltage of the laptop charger. website of V chart → website of laptop charger specs

26 July 2008

I wanted to start getting some Voltage information on all the motors out of the 3-4 printers I had been given. ~~So I put~~ Having already done Voltage tests on a car and scooter alternators, today I ~~am~~ did ~~the~~ voltage tests on a range of much smaller stepper AC, dc, small plain dc and a servo motor. I did this using a variable drill and a Voltmeter. The variable drill could be adjusted to about 10 different speeds labelled A → J. I attached each motor shaft to the drill in turn and measured the voltage each motor produced at each of the ten speeds and recorded them on a table. To find out what speed (rpm) the drill was turning at each of the ten speeds, I used a little device that you push up against the end of the drill and counts 1 for each revolution and doing this for each speed for exactly 1 minute, told me

the rpm for each of the different speeds A-D J. It turned out that the lowest speed of the drill was nearly 600 rpm which is probably close to double the rpm to what I could hope my wind turbine to do (refere to research). At 600 rpm, the best motor from trial, produced about 6V. When I connected this motor to a small 9V light, the motor would light it brightly for a split second when the motor was given a good flik. The fact that I need the Generator to be producing well over 14.1 V (from Roger) at 250 rpm and the motors/generators that I currently have cant even do that at 600rpm caused me some major concern. After consulting with Mr Watson and Mr Wrapley the electronics teacher, we all agreed that if I want to produce the required voltage, the generator actual size is going to have to majorly increase and a suggestion was given that I should look into Washing machine motors.

That Afternoon

- I found my mums friend, who's husband actually fixes washing machines. He told me to come around to his house and he would see what he could do. When I went around, he explained to me that washing machines don't just come in one nice little package, they ~~are~~ consist of a fairly large stator(coils) and a kind of flywheel (magnets). These to parts can be seperated and the axle for them is built into the bottom of the washing machine. He found the barrel part of the washing machine (with the so called: smart drive motor attached to it) that I could have, he enformed me that the axcle would have to be customly machined to be suited for anything else other than the washing machine. He also informed me that if spun fast enough, the smart drive motor can produce a lot of power and Amps and warned me to be carful.

Next day

- I started doing ~~some~~ tests using the smart drive, ~~As soon as~~ I temporarily established two wires which came out of the motor as my +ve and -ve. when I connected the same ac light bulb used with steeper motor, the smart drive light

Ha the ~~bulb~~ a bulb even with just a lazy twist using my hand. I then connected the meter across these two wires, with the flywheel nearly fully covering the stator, I twisted the flywheel as fast as I could and managed to reach a max of about 60V ~~at~~ wich I thought was pretty amaizing.

~~Next day~~ 29 July 2008

- Today I researched the smart drive motors. I found out ~~—~~ A lot of info on them ~~—~~

The smart drive motors are actually used in small diy wind turbines today as they produce an amaizing amount of power at very low r.p.m. Major issues with the smart drive for my clients issue is the plain weight, size of the motor, it exceeds the weight specification and size specification but it would definatly produce a very usable/practicle amount of power. Another issue to overcome with the smart drive motor is the cogging affect which means ~~the~~ the motor has a large inertia and when going can be noisy and vibrate.

Next day 2 August

- With further research into the cogging affect that smart drive motors face, there are numerous methods that can be used to reduce the cogging to nearly nothing without affecting power output too much.

Next day 3 August

- I went too see Mr Wrapley the electronics teacher about the circuit board ~~robot~~ attached to the output leads from the generator. I explained ~~what~~ that a varying generator output voltage^{ac} will be going into the circuit and I need a constant ~~Dg~~ 14.1 V D.C coming ~~outed~~ out of the circuit. He actually had that exact circuit sitting on his desk that he bought from a circuit designer down the road for use in his scooter. He told me that he was not going to use it anymore. This circuit ~~m~~ needs a single phase ac input and puts out 14.1 V D.C. The circuit contains a high amperge regulator and rectifier so it would probably suit my projects need quite well.

sore wrapley

Next day 5 August 2008

- I now new that the smart drive once decogged can produce a good amount of power at fairly low windy speeds. I also now new that there is such a circuit to out put a constant voltage from a p.m motor. But the issue is the plain weight of the motor, I realised that in order to get the required amount of energy that my clients needs, the weight specification may have to take a hard blow. It is just simply not possible to get any system as light as my client first wanted and to produce the amount of power he wants to get out of it. I thought I better just make sure that there isnt a syster or motor/generator that would suit my clients specifications better. ~~What~~ What I then did was try ~~t~~ What I decided to do next was to see if I could find something inbetween the low power

output ~~stepp~~ ~~and~~ but light stepper motor from a printer and the high power output but quite heavy smart drive motor from a washing machine.

Next day 7 August 2008

- I went to two places ~~and~~ to see if they had what I needed. The first place was Epulse electrical Intd, they did not have anything for me but suggested that I may get what I wanted at a reminder. The ~~man~~ person I talked to at Epulse also suggested Mount reminders wich was ~~a~~ just down the road. So I then went to Mount reminders and had a talk to the person there, he ~~said~~ ~~was not there~~ ~~shave~~ didnt know much about smartdrive motors and he didnt ~~know~~ have any type of stepper motor that I could have ~~and~~ which would be a good generator. He ~~did~~ asked me for my contact details and said that he would talk to his motor mechanic ~~tomorrow~~ the next day and then phone me.

Next day 18 August 2008

- The man from Mount rewinds phoned me at about 8:00 am and said that ~~he~~ him and his mechanic had had a talk and suggested that I try find a gentle Annie washing machine and have a look at it's motor because they are ~~for~~ evidently very large P.M stepper motors. He also said that I should give Doug Broadmore a call as he might now something about smart drive motors. later that day I first looked ~~in the phone~~ on trademe to see if there where any Gentle Annie washing machine motors for sale ~~there~~, ~~was~~ there was one but looked very rusty so I didnt buy it. I then looked in the phone book and ~~found~~ on the first company I found (that I thought may have an old gentle annie motor for me) that fixed washing machiens was Mike Molony electrical. So I went ~~there~~ to see him and luckily he had an old gentle annie right there that

he was about to take to the dump. I told him who I was and what I wanted and he was happy to let me take the motor out. He also kindly suggested that I should take the power box, aluminium drive wheel and switch board as they contain a lot of useful parts and components. He also told me the smart drives only come in one diameter

Next day 25 August 2008

- I anglised the new (large) stepper motor

- I anglised by inspection the gentle annie motor. It is very coggy and has 11 wires coming out of it. Over two of the wires coming out of the motor, I got 60V spining the shaft with a piece of string. This gentle annie motor is about the same weight as the smart drive, and is a lot more compact.
I know know that smart drives come in one size, are fairly heavy, produce a large amount of voltage at low rpm. I also know that gentle annie are

and they also have a bit of cogging (there are known and proven methods that I have researched to reduce cogging). I also know that the gentle annie motor is a large stepper motor, is about the same weight as a smart drive motor and has a large amount of definate cogging (no methods yet found to reduce cogging in a gentle annie motor). My next step is to set both the smart drive and gentle annie up on the the lathe and check both of their voltages at a number of r.p.m's. I can then do things to each motor, put them back on the lathe and see any comparison to initial tests.

Next day 2 September 2008

- I started preparing the smart drive to be fitted to the lathe. This will be done by cutting around the large bearing in the bottom of the plastic barral it round then putting it in the lathe and

7 September 2008

- I started preparing the smart drive to be attached to the lathe, this was done by cutting around the large boring in the bottom of the plastic drum. When it was cut, I came up with a method of testing it's voltage at different r.p.ms (not decogged) This was to grip the axle/shaft in the lathe. The axle was attached to the inside of the bearing and the outside of the bearing was attached to the plastic moulded around it. The stator is attached to the outside of bearing/plastic and the magnetic hub is attached to the other end of the axle. so that all means, I can hold the plastic (with stator attached) and then turn on the lathe meaning the stor stays still and the magnetic hub rotates around the stator.

At the following r.p.m, I got an open circuit output voltage of

Table

8 September 2008

- I put the exle coming out of gentle anie motor in the lathes chuch and measured the open circuit voltage at differen rpm.

Table

Next day

- I went to see Steven at the Home applence stave in fraser cave "contact details" to see if he had a ~~#~~ smart drive motor with 1 mm winds as the one I have has .6mm with a different hub. So I wanted to see how the ~~outv~~ output voltage of a 1mm winding smart drive compared to a smart with .6mm

1mm winding table

feeling by hand, the 1mm has a lot more cogging and produces (from table) a lot less open circuite votage.

~~Next day~~

- ~~I started to decogg~~

Next day (9 September)

- ~~I emailed Randy from www.Randyworkshop.com and asked him~~

- After doing some more research into smart drives, I found 2 main methods to decog them, 1 round corners of each pole, and 2 rewire them to 7 phase and use a mag. hub from a new washing machine. ~~I also found a method of rewiring them to produce more current and less V.~~

~~Tried to find new hub and failed so I emailed Randy~~

10 september

~~I went to CHAPS to~~

- I thought the rewiring and using a late model seemed to be the best option because www.....com claims that using this method, cogging can be reduced to nearly zero. So I decided to try to find a hub from a ~~Hax~~ Newer model F and P Whashing machine. After going to CHAPS and asking them, ~~we~~ visiting the ~~dump~~ dump and some more research, it turned out that they are very hard to find.

Next day

I was

- Very confussed about what to do about the cogging and high output V so I emailed Randy from the www.randyswork shop.com website and asked him to explain to me. He said that you must reduce cogging so that your turbine starts spinning at lowish wind speeds. He said that Eclnnovation had consulted

with the F and P Engineers and the best way to decogg them is to round the edges. Randy also told me that you should rewire the stator so that the uneeded excessive high voltage & output ~~is~~ is decreased and output I is increased. This can be done a number of ways. 1 way is to rewire the stator from a 3 phase single star to a 3 phase 7 star in parrallel. This really confused me so I went onto another website www.fieldlines.~~com~~ and emailed a man named James who has had a lot of experience in wind turbines and smart drive motors. I asked him about rewiring the stator this way and he said that I would get 1/7 the V at the same r.p.m but the factor that the current would increase by would be even greater factor. After a long discussion he said that he would help me design a set of blades to fit the motor and rewire the motor in a way to get more out of it.

11 Sep 2008

-I desided that I was going to have to decogg the smart drive and doing so can only make things better. As there are two round ways to do it (using new hub and rounding each pole.) and I could not do the way wich involved ~~buying~~ getting a ~~new~~ hub from a new washing machine as they are rare to find second hand and expensive to buy new. So I looked into rounding each pole, information on this was sent to me from Randy and more information was available on the Eco innovation sits. I found that you just have to lightly curve each pole (picture used as guidline) and the best/quickest way to do it is to use a power file. I didnt have access to one of these so I went to Mitre Ten Megga to see if they sold power files. They did but there were $76 which was far out of my budget so I just had to round each pole using my dremmel.

12 September 2008

- Continued decogging the smart drive motor. The process was very slow and time consuming

13th

- I finaly finished rounding the poles of the stator. I then put it back on the axle and reattached the magnetic hub. I found that the force required to start turning the smart drives hub was at least 50% less so I had achieved huge succes. I then tested the voltage at the same r.p.m's as I did prior to decogging across one phase. I found that at most there was a voltage drop of 3V which is very acceptable considering the huge decress in start up torque required.

Next day

- I wanted to start making/designing the blades. So I decided to email James asking him for some help as this is an extremely advanced

16 september 2008

- Today I went to see My Engineer Mentor. We talked about designing the blade. He said that It is such a huge job designing blades and there are so many variables, and people ~~going~~ go to University ~~for~~ four years to be able to do this kind of stuff. I told him that at this stage I was looking at making the blades out of angularly cut P.V.C and ask if he could give me some rough ideas at what shape I will be looking at. He gave me som really basic ~~x~~ gide lines for looking at pressur and force that would be exurted on a flat blade at given speed and said I could relate this to the curved P.V.C Blade to get a real rough idea of the r.p.m at any wind speed. I was not really happy with doing this and thought that there must be some better (not too diticult) way of calculating the blade shape, but had to leave it at that for the moment.

We then talked about the stator of the smart drive. It was connected in 3 Phase single star configuration and I understood how it worked but was not shore why it worked. Brian explained that accross the three turminals, there was always the generators output voltage between two terminals at any one time. In other words, the positive and negative terminals were always changing between the three turminals. This made a lot of sence to me.

18 september

- After thinking alot about what I should do about the blades, I desided to email James and ask him. He was very happy to help me as much as he coald. I emailed him back an forth a few times explaining who I am and what I was designing.

- I then emailed James back asking him about the blades. He said that P.V.C is for blades is ok but noway ideal. He also said that I should carve my own out of wood, it takes longer but he said I will learn so much more and they are better overall.

19 septembe

- He emailed me asking me to do some resitance and other tests on my stator and send the info to him and said that he will do some calculations on the blade shape

topic of design. He emailed me back, ask me some questions about what it is that I am wanting to do, and he said he would do some calculations.

Next day.

- After a ~~few~~ few days of emailing back and forth, we eventually figured out the blade size/shape to turn my decogged stator at as lower wind speed as possible. James then also helped me or showed me the way that I should rewire my decogged stator to get the best power production possible to best suit my client.

20th sep

- Today I drew up the 3 different blade shapes on ~~cad~~ Pro desktop, all 3 were attempts to get as close to the measurments that James gave me. I could not make a blade that was exactly the same shape as his theoretical blade because of

my size restrictions and because of the time and resources that I had. One of the 3 different blade shapes the I designed ~~com~~ was as close as I was going to get it to the shape of the theoretical blade. I then emailed James again and he said it was fine.

21 sep

-I went to see the wood Tech teacher and I showed him the Pro desktop drawings of the blade shape and asked him if he could give me some help to get started. He thought that it would be extremely hard to get all three blades the same weight and balanced. He suggested three other ways that I could make them. The first was to make them out of ~~1~~ thin sheets of ply wood glued together and pressed into the twisted shape of the blad so that all I had to do ~~was~~ is carve the ~~ar~~ airfoil shape into each ond and they should be a fairly consistant weight.

- This seemed to be a lot more achievable. When I looked into how I would make the press, because of the tape in the ~~w~~ blade, it was not as straight forward as I had origanaly thought. The next method he suggested that may work ~~are~~ were carving them out of paulownia (soft but strong and light hardwood) so I looked into buying some of this wood. I is a rare wood, And I could not find anyone who was selling some. The last method that he suggested was to carve them out of some sort of foam but was unshure about doing it ~~that~~ like this.

Next day

-I started to look into ~~pot~~ making moulds from polystyrene and polyethene and I also looked into fiberglassing these materials. I found that most foam sort of materials can be cut with whats called a hot wire, which is basically just a thin piece of nicrome wire and you stretch it out so it is straight then you pass a current through it and it goes

red hot. You can then very easily cut polystyrene. From some research, I thought this method was very practical, and achievable so I decided to go with it. I found that I should use ~~polyst~~ polystyrene and cover it in fiberglass using expoxy resin (not polyester resin as it melts polystyrene).

25 sep

- I went to see my Technology mentor about the method and how, when fiberglasses, I could attach the blades to the smart drives axle. Mr Watson ~~seem~~ thought that the fiberglass/polystyrene blade making method would be fine and very strong. And we both agreed that a metal plate could be fiberglassed into the bottom of the blade and that metal plate could then be attached to a metal disk which is bolted to the axle (details will be sorted out later)

26 sep

- I went to see the electronics teacher about making the hot wire cutter. He gave me som nichrome wire ~~cut~~ and a battery charger which put out 24V from the wall. All I had to ~~down~~ was make the frame which holds to wire straight, possibly spring loaded to account for wire expansion when heated.

Next day

- I made the hot wire from and did some tests with it on packaging polystyrene, it worked well.
- I then went down to carters and bought the required amount of polystyrene.

Next day

- Today I ~~retured~~ measured out the 40mm and 20ml polystyrene, cut them to size and glued them into one big block that I could cut the blade from ~~th~~, which ends up being to size, shape and have the necessary twist ~~th~~ in it.

Next day

- Today I used the hot wire device that I made to cut the shape blade that James helped me figure out. I worked very well, except that the end of the blade was too thin and was going to be far too weak if I ~~was~~ am going to be fiberglassing over it, It will probably just bend so I am not going to be able to use this blade.

29th sep

- knowing that the method using the hot wire does work, I decided to continue with this method and make all three blades using it. So today I Made a thiker and slightly longer (givin the polystyrene more strength) end rib. I then repeated the hot wiring process. It worked a lot better & and I thought ~~in~~ that in some of the hard to do areas, I would leave them alone and then later get a sanding block and finish it off.

Next day

After all the blades were rough cut ~~from~~ using the hot wire machine, the sanding process began. This was an extremely time consuming process and all three blades were done similtaniously so that they could be compared and made more similar. A good result of similarity was eventually atchieved.

Next day

Now that I had my blade moulds done, I started to research how to fiberglass. I found a few methods for boats and that epoxy resin must be used on polystyrene as polyester resin eats polystyrene in seconds. I just could not find any very specific methods so I looked in the phone book for nearby fiberglassing companies, and found Impact Fiberglass. So I went there and talked to a man called Ben Graham. I discussed with him for a while about what I was doing and the help that I needed. He advised me to coat the whole blade in resin first and let it dry. You then cut one half of the blade shape from your cloth. You then coate the one side in resin and whilst it is still wet lay your fiberglass over it. You then apply more resin to any dry areas and then use a fiber glass roller to super flatten it all.

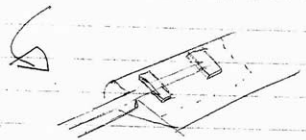
Next day

- I went to see Brian. We discussed the piece of metal that will be allached to the blade (resin) and then that peice of metal will be bolted to the centre plate. I went in with the idea of using a strip of flat 2mm steel

But Brian and I both agreed that it would be strong enough

But when I told Brian my plan he went into the forces that will be acting on the blade and this idea of mine would only be in good for about 2 out of four forces. So we had to come up with a better way. He suggested a box section which was good except not strong twist ways. So we both decided that a couple of metal plates welded to the top of the

So now the plan was to get some lengths of box steel, weld metal strips onto one side of the box steel and then sink it into the blade, with the metal strips sitting on the surface of the underside of the blade



With a patch of fiberglass underneath the steel and then another coat of fiberglass over the entire blade, which should give a very strong set up

Next day

- Today I cut out and welded all three steel blade attachments. ~~This~~ Each consisted of a piece of square steel with two small strips of sheet metal welded to it, about 20cm apart.

Next day

I cut grooves into each blade so that the steel attachments would sink into them and sit flush with the bottom of the blade.

3 October

- I received the 1L bottle of resin that the school had ordered a few days ago.

- Today I put one cote of resin (mix ratio 1:3) over all three blades. I used a foam roller which was O.K but I decided that I would try to find a better way of ~~the~~ spreading the resin evenly.

Next day.

- Today the first rote of resin had dried, it took about 36 hours. I then, this time ~~painted on~~ an using a paint brush, coated all three blades in another rote of resin. The paint brush seemed to be fine for spreading the ~~glue~~ resin.

Next day

Another 36 hours later and the second rote of resin was now dry. So today I ~~was going to put~~ started to fiber glass the steel blade attachements into the polystyrene blades. I did this by cutting patches of, given matt fiberglass big enough to ~~cover~~ cover the slots in the blades and to have an extra 2-3 cm around the slot. The cloth, still dry, was then pre fitted into the slot. to get it to fit well, I had to cut slits ~~in the~~ near the end of the slot. I then mixed up some resin, coated the area of blade that the cloth was going to cover (including the slot). When it was all

nice and wet I lay the cloth down, pushing it firmly into the slot, and painting plenty of extra resin in and around the slot to ensure a snug fit for the steel. I then pressed the steel into the blade so that 15cm was sticking out from the end of the blade. I then coated the top and surrounding area of steel with some more resin as this is a crucial strength area. I completed all three in the same way and then left them to dry.

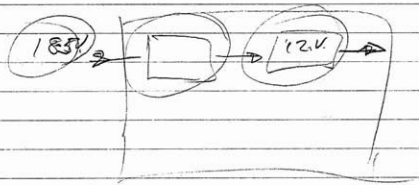
For the duration of October I completed the build of the wind turbine.

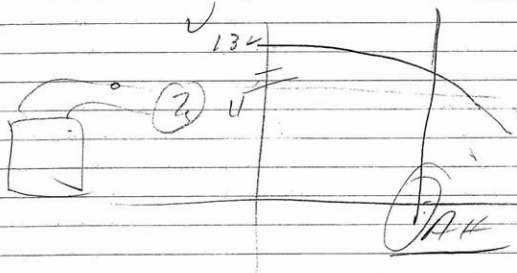
For the whole of October and September I completed the construction of the wind turbine and on 20 October I did the first completed test and the whole device worked very well.

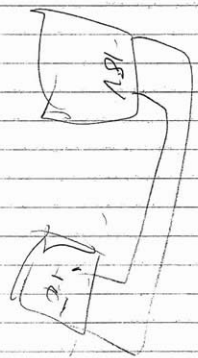
14/5/08

Laptop 10.8V 52 whr. 5 AH

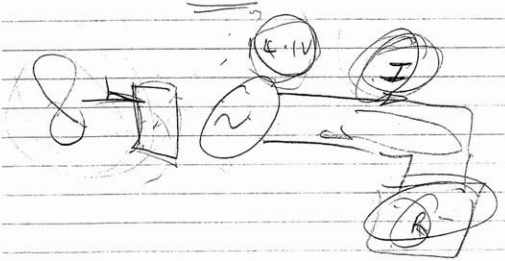
Laptop input 18.5V.

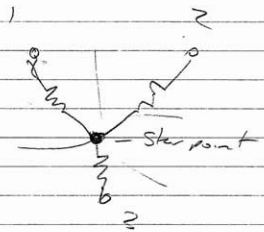


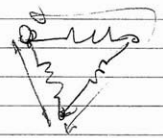


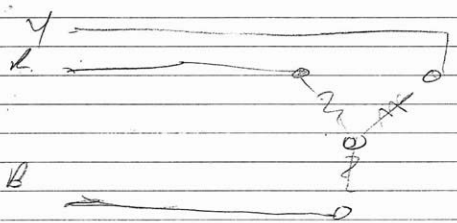


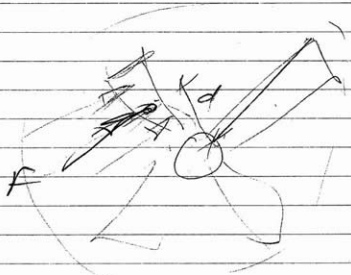
3.6A @ 18.5 AH

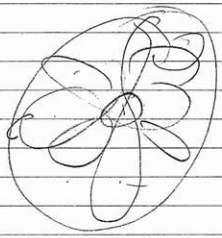












• steel and tube for turbine [illegible]pde

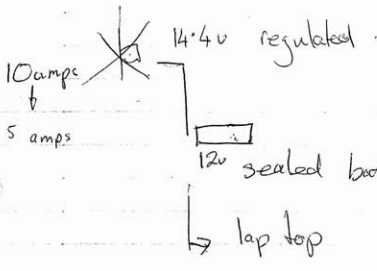
lap top → 18.5 V
3.5 A

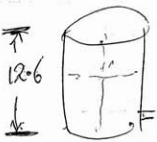
1 phase Ac
↓
regalator
↓
Transformer
step v up
↓
rectifier
↓
Battery

Ivans auto electrical
adrenelin simson motorcycles

18.5 V
3.5 A

laptop





V. = pressure.
Amp = litres.
Watts = H.P.

13.8.
12.6
12.2.

3 multi bladed fan run in >15 m/h
blades only
winds