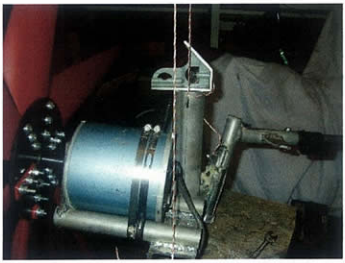
This next picture is a music stand. This one is designed to fold down into a very small bag for transportation, which is appealing to what I am doing. The base consists of three legs, which fold out when the top of all three legs is held and then pushed down whilst holding the main pole with your other hand. The way that the pole extends is another good idea for the wind turbine pole. Each pole slots into another pole slightly bigger than it and that pole slots into another pole even bigger and so on. The first problem that I can see with this method is that if I am going to have a roughly four-metre pole which folds down into a length of one metre, the bottom section is going to be overly wide and the top section will be so narrow and weak. So fro this reason, I think I am going to find some way of folding a roughly one metre pole to fit in a one metre box and join it so it is firm and strong when all in one piece. An idea for doing this that comes to mind is to have roughly four sections of one metre pipe that I somehow join together. The next few pictures show some methods for joining pipe. The firs being a socket, where you thread the outside of each pipe and then to join two sections you thread each end of the two pipes into the socket. The other picture shows a kind of sleeve that slips over the end of each of two pipes and the sleeve does not quite go all the way around the pipe so that when you tighten the two bolts, there is space for the sleeve to tighten around the poles and secure them firmly together. The far picture shos two silver pipes, one of them has another narrower pipe joined to the inside of it an sticking out a bit so that another pipe can slot over it. The problem with this is that there is nothing that actually holds them together. The final method is to use a socket. You thread the inside of each pipe and then thread both of them onto a double nipple joiner. I discussed this with Brian, my engineer mentor. He said that the sleeve and socket are probably in his opinion the two that show the most potential. He said that he would choose the socket as he has experience with some joining of water pipes and this is how they do it and he said it is and extremely strong and firm join.

Generator attachment research



This research looks into how the actual smart drive motor is going to be attached to the top of the pole. As you can see form the bottom picture, the smart drive is quite a bulky motor/generator. It has a big plastic cylinder that is bolted to the stator and my thought for attaching it to the top of the pole by some how attaching the plastic part to a plate on top of the pole. The plastic part on the smart drive has to be there as there is the bearing inside it and it looks like quite a heavy duty one so it would be good if I could take advantage of it by using it. The first picture here shows a motor, which is of similar size and shape to the plastic cylinder on the smart drive. This picture shows the motor being attached to a piece of wood by two steel jubilee clips, which is quite a good idea. My only concern would be weather or not the motor can slide side-to-side using this method but it does look like a fairly firm securing. The second picture uses the same method put the cylindrical motor is placed in-between two steel poles, which stick outwards. This would be very firma and secure, as the motor would not be able to move at all. The last picture shows a motor that is secured by two pieces of metal rod threaded on each end and bent to fit the shape of the motor. The two pieces are then put over the motor and through two holes with nuts to fasten the whole thing down. This is an interesting method. I will start some concepts for this using what I have learned here and see if I can come up with anything else.

Guy wire and peg research

This research shows different methods of securing a pole with quy ropes. The first picture at the top and to the left shows how the ropes attach to the pole. This particular method is a small section of pipe that is larger than the pole and the piece has four small eyelets welded to it. The section of pipe then slips over the pole from the top and then slides down until it hits a small stopper. The picture in the middle is similar but except it has little hooks instead of eyelets and the whole thing actually bolts to the pole. I do not see any advantages of this one over the first one and to me it seems over complicated for something that can be just so very simple. The picture on the right at the top shows how the guy rope secures to the ground. It uses a peg to anchor to the ground, which is the simplest and mot common method used. Around the piece of peg that sticks out of the ground is a little plastic cover which is just a safety method which is quite good, encase some one walking by does not see the peg, and kicks it, the cover will reduce damage to the persons foot. On the end of the guy rope its an adjustable hook so that once you have hooked onto the peg, you can tighten the rope. I think from looking at this research, the methods that I use for guy ropes and pegs can be a lot simpler.

Horizontal swivel research (yaw system)

This is research for the horizontal swivel mechanism or the mechanical way that the wind turbine motor and blades swivel on a horizontal axis to face into the wind. I found these couple of pictures that show two different methods. The methods are not what you would expect. Coming into this I thought that the obvious solution was just some big thrust bearing but it turns out that if it is too smooth, it can damage the wind turbine. If the horizontal swivel is so smooth that a soft nudge spins it around twice, when the wind is gusty, the whole thing will be going crazy. So what I have found is that the best way to make the turbine spin is to have one pipe fitting closely over another pipe with a smooth metal on metal contact. This contact does have to be as frictionless as possible otherwise it will just wear down in an hour. So I will have to draw some concepts up and see what I can come up with, I think I may have to do some more research into this issue though. One thing that I did think could work is a wheelie chair so I will also look into those.

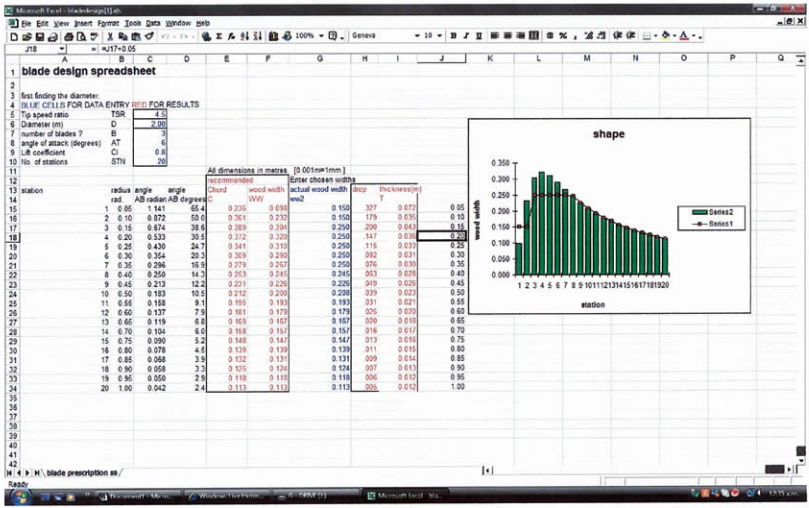
Complete turbine container research

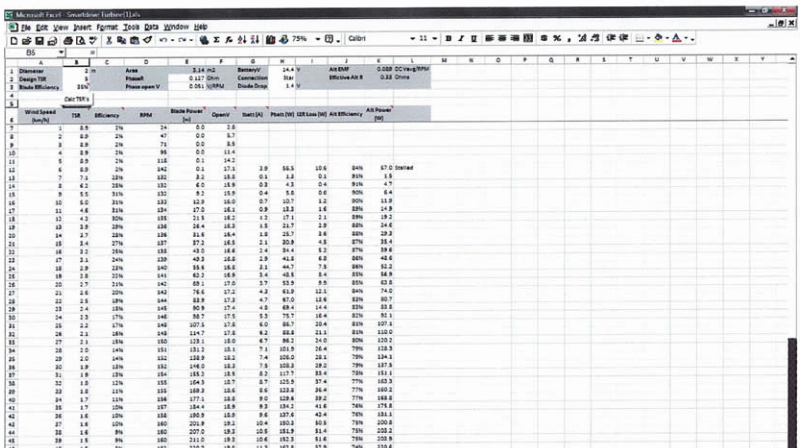
I am now looking into how I am going to actually contain the whole wind turbine. It is probably a bit too soon to look into this as I do not have any definite sizes but I can just get a general idea of what or how I am going to pack the whole wind turbine up. This research picture shows my first idea, just a big box (size according to specifications) that holds all the parts for the wind turbine and any tools needed to set the wind turbine up. It can also house any electronics needed. What I am thinking of doing is building or buying a box that is the correct size and then putting brackets and separators inside it so that all the components have a place and can be securely fastened inside the box. This will just be for

Tower base plate research

This is research into the base plate or how the pole sits on the ground. This is an important part of the wind turbine as it will determine it's stability when set up. There are a few images on this page and all of them lean towards having a plate that the pole attaches to which seems to be good as it would be quite secure and easy to set up which is one of the design specifications. Ideally a wind turbine would be fastened to a concrete base to give it supper stability and strength but as my client wants a portable wind turbine this plate style base seems to be the best option. Provided that you can find somewhere to set the wind turbine (which my client says there is always in the locations that he goes) where there is a small amount of flat open area and some reasonably hard ground. If I do decide to use this method, the next issue is how to attaché the pole to the plate, is there going to be a swivel that it attaches to, is it going to bolt to the plate? These other small issues will be solved later when I start to do my concepts for this part of the wind turbine.

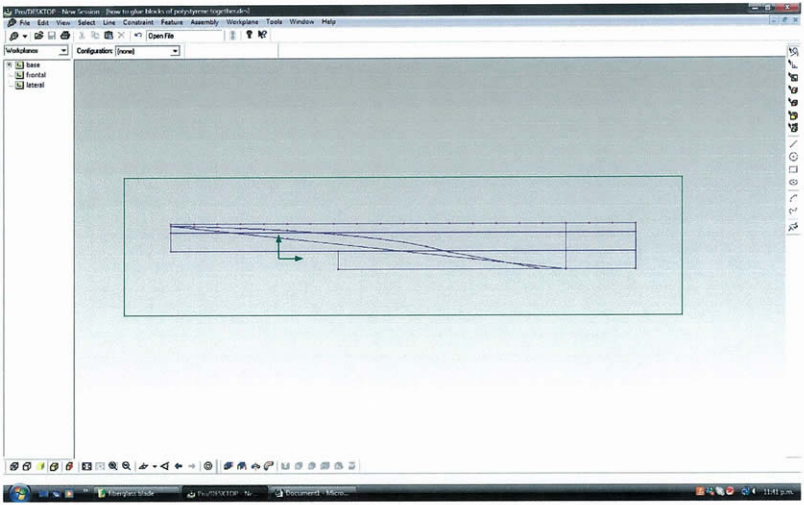
Designing the optimal blade shape



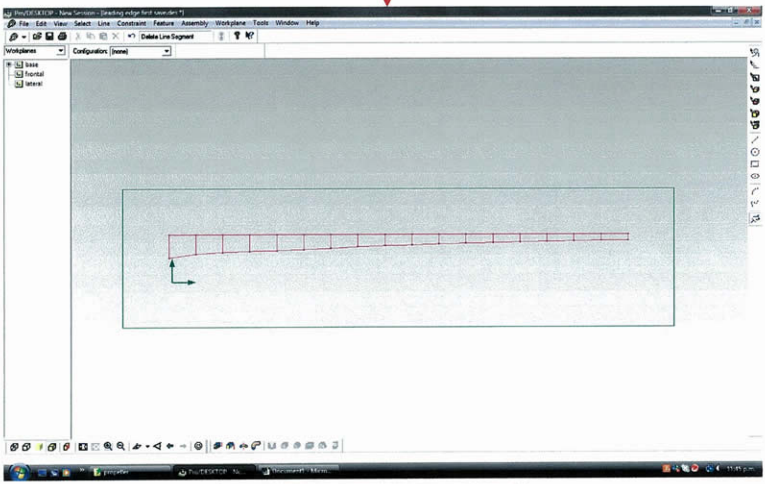


James, an experienced technologist, showed me some equations that could be used to calculate different blade dimensions for max efficiency. From there I then created these two spread sheets which were extremely helpful in calculating, number of blades, diameter of blades, and all the specific shapes and dimensions of the blade. I was then able to create a blade that started up in as lower wind speed as possible, operated as quietly as possible by reducing drag and has good low and high wind speed performance, and this now meant that the wind turbine met a lot more of the design specifications and met others more strongly. The following are CAD models that I made of the blade.

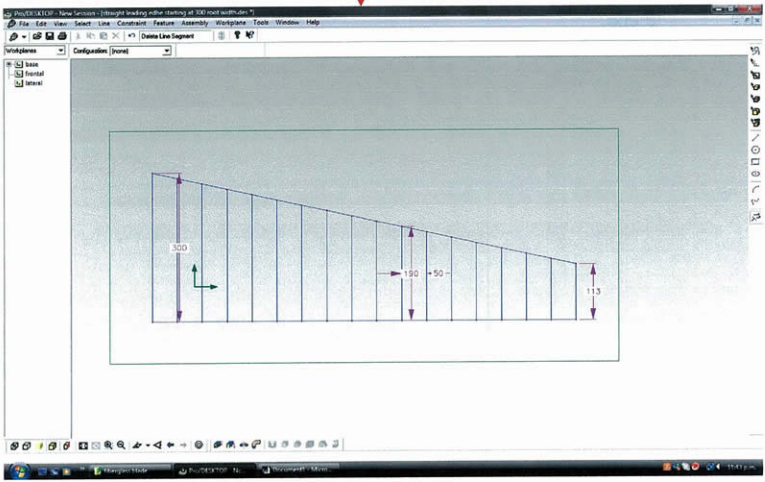
Optimal and real blade shape, viewed from the trailing edge



Blade shape, viewed from the leading edge



Blade shape, viewed from the top.

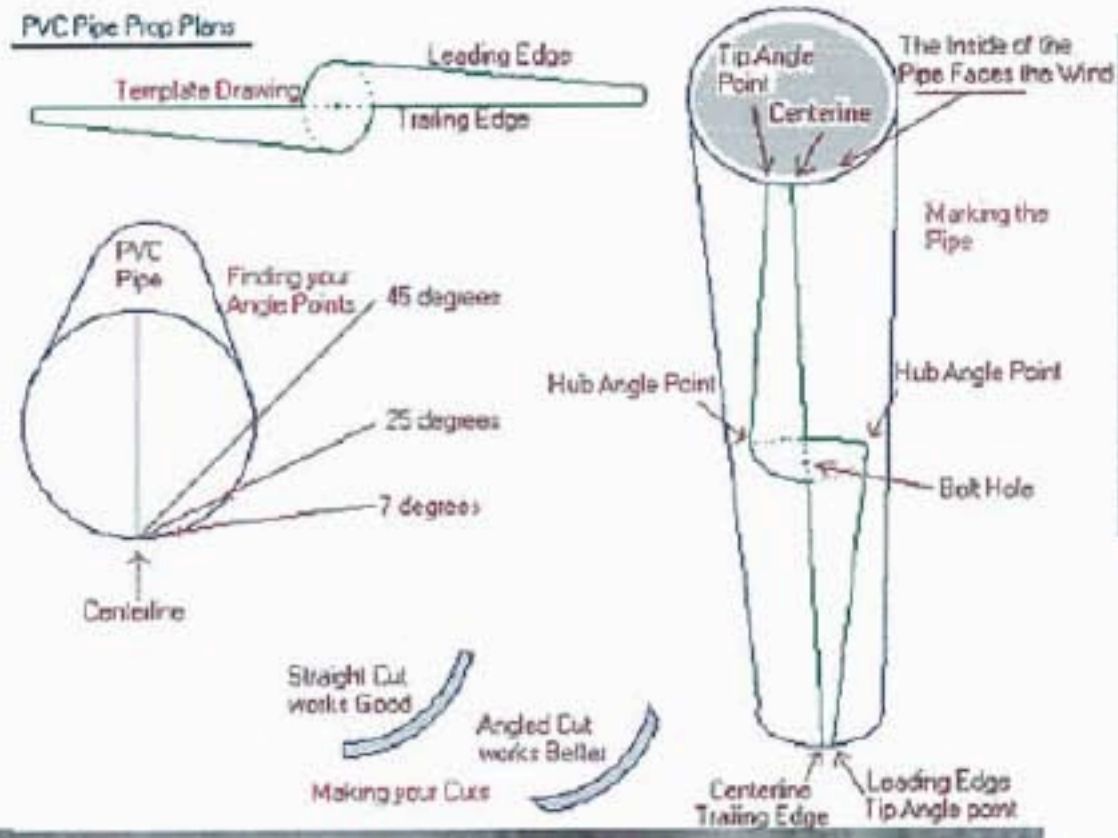


20/10/09 5:10:31 P

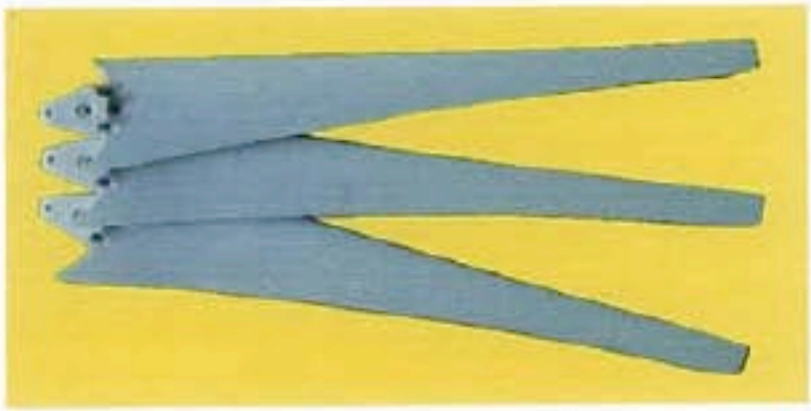
Options

Evidence of process being undertaken.

Wind turbine blade research



20/10/09 5:14:30 PM
Options
Evidence of the use of functional modelling to test ideas and inform technological practice.



This is research into the construction of the blade as I have already got the dimensions for the highly optimised and efficient blades that I have designed. These blades have to be tough, strong, durable, light, and highly efficient for them to meet the design specifications. These images above show various ways for construction of blades which all have their good and bad points. The blades that I have designed contain 3dimentional twists and curves and so I have to be able to do complete these specific blade aspects with the blade construction method that I choose. My Engineer has informed me that it is very easy to sacrifice crucial strength for lightweight and so I must watch out for that when deciding on a material. The above materials and blade construction methods are firstly wood. I talked to one of my existing technologists and he said that wood is definitely the best material to make wind turbine blades out of because it is fairly light, very strong, doesn't break down, flexible and can be carved to any shape. The issue that I have with wooden blades and my project is that I don't feel that my skill level is at a high enough standard to be able to carve three near identical blades. The process will also take a long time and so time is also against me in carving blades for my clients wind turbine. Another material used in the above pictures is PVC piping cut on an angle. This I thought was the answer but when I talked to one of my existing technologists who is experienced in the field, he said that PVC blades are cheap, easy to make and extremely inefficient and are not advisable to be used and they can get brittle with constant sun exposure. This material did not

seem as good as it did before and I thought about it for some time and then realised that there was not many other methods currently being used to make small wind turbines. I then looked into plywood moulding which did seem as though it would work but then when I went to do some calculations for making the jig, I found that it would be so complicated to mould an object that had 3d shape to it and that was constantly changing shape and thickness. With no were else really to look, I turned to fibber glass. The way that fibber glass is conventionally used to make a sort of blade is to make a solid fibber glass blade. I new that I did not have the budget to do this and so came up with my own way to make a blade using fibber glass. This method employs aspects from model aeroplane wings that are made of solid foam. It thought that if I could make an exact replica of my wind turbine blade that I designed, I could cover it with a layer of fibber glass and that would surely be very strong. I consulted my engineer, and he seemed to think that my idea could work but wasn't sure how many of fibber glass would be need. So I went to see the guy at impact fibber glass and he said one layer may do the trick but what I should do is first do one, and see how strong it is before I decide what to do next. I consulted my client and he too seemed quite happy with this new way of constructing wind turbine blades that I had come up with. So with some more research, I eventually decided to proceed with this method. I had the idea of making the polystyrene blades using a hot wire cutter and so I had to make one of those first. I also had to do some research into how to fibber glass. When I had made the hot wire cutter using nichrome wire and a battery charger. I could get the polystyrene and start making the blades. I did it by laminating sections of foam together from flat pieces. When I had blocks of foam that were of similar dimensions to the blades (3) I was then able to stick cutting the details, curves and twists out exactly using the hot wire cutter. I achieved a blade that was very close to what I had designed and was much the same in comparison to each other, which definitely give the blades the incredible balance that they have. When I was actually cutting the blades out. I stuck small jigs to the side of each block of foam and they were positions in a way so that when I rant the hot wire along the top of these jigs. The perfect blade shape appeared with all intended twists and curves. When the blades were all cut out of the foam, I had to figure out and design a way it which the blades could be attached to the axle. I came up with the idea of embedding steel box section into the polystyrene blade. I did have to consult my engineer and teacher with this because it was quite a crucial part and needed to be able to stand up to a lot of force. After consultation with my engineer and teacher, I cam up with a method that took into consideration all forces acting on the blade at any one time. This method was to cut a slot out of the foam, fibber glass the slot, push the steel box sections with small steel taps hitting the surface of the blades and then to fibber glass over the entire blade. The purpose of the steel tabs was so that the steel box section could not pull out of the fibber glass and also to give the steel box section grip when the blade tried to twist. The steel box section extrudes out of the but end of the blade and has two holes in it where it is bolted onto a small angled bracket. (See design sketches for further detail on the blades and how they attaché to the smart drive axle.)

20/10/09 5:15:35 PM

Options

Evidence of client consultation and interactions with client.

Consultation with client

After looking over how I have planed to build the blades for you wind turbine, knowing that it is a different way to build blades but they will be ideal for what you want, do I have your approval to start building them?

After looking at how much work you have put into the design of these blades, I too strongly feel that they will work. During the design of these blades, it looks like you have taken into consideration all of my specifications with large emphasis on weight, noise and efficiency. From the information you have presented to me, I am confident and happy for you to start building these blades.

Signed Roy Anderson

5th July 2008

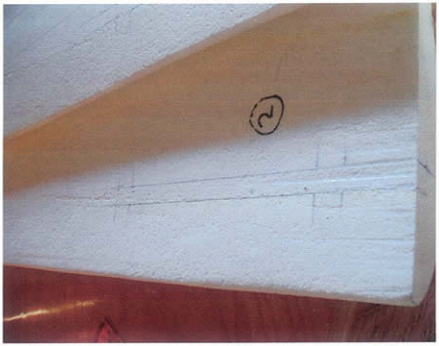
Construction of the blades

Buying the polystyrene

Cutting it up into pieces which I could then laminate together

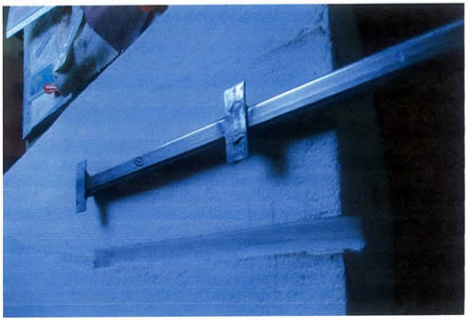
Building the wire cutter

Cutting shaping and smoothing the blades



Building the steal insert. These are what are fibber glassed into the blades and then they can be attached to the specially designed axle bracket.

Cutting the slot for the steel to slip into



Once the blades all had a good shape, I gave them a smooth finish using this builders bog and then sanding smooth.

Applying the first sealing coat of resin.

20/10/09 5:16:17 PM

Options

Photographs used to illustrate methods to allow their technological outcomes to be realised.

Allowing resin to dry

Fibber glassing process. I put a small strip of fibber glass in the slot in the blade before inserted the steel. This would mean that the steel is completely surrounded by fibber glass meaning it would be very firm.

20/10/09 5:17:06 PM

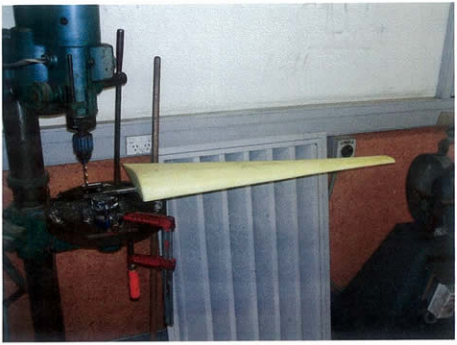
Options

Investigation into relevant codes of practice and safety practice would enhance this portfolio.

Trimming sanding and filing the new fibber glass.

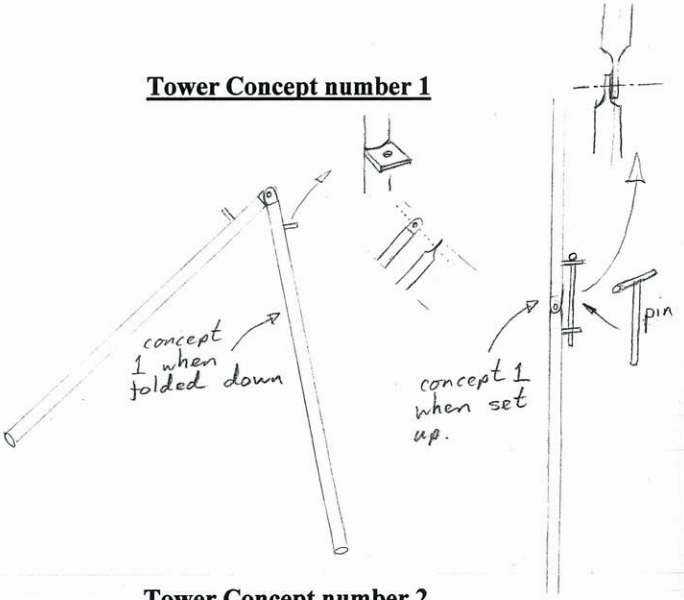
Applying final patches of fibber glass to the ends and leading edge

Final sanding of the fibber glass.

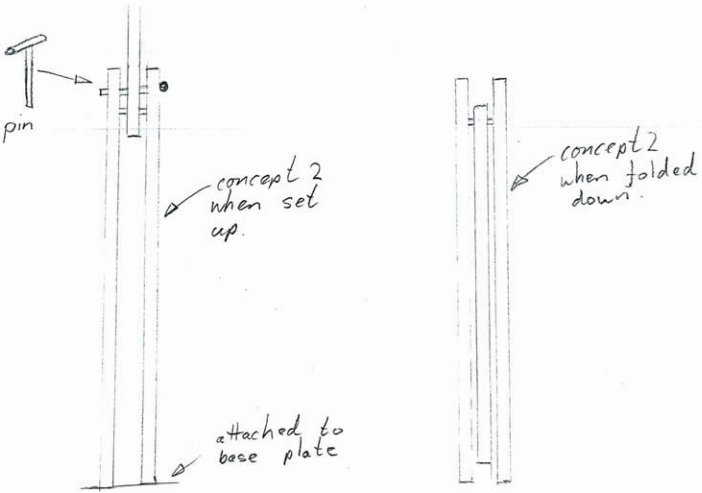


Drilling the hols in the steel.

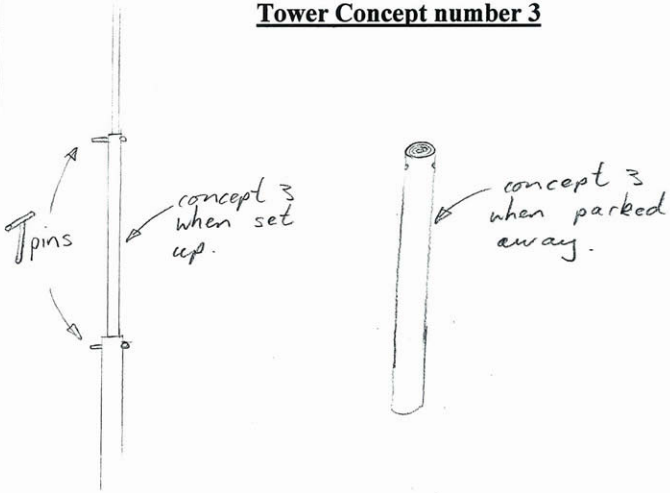
Tower Concept number 1



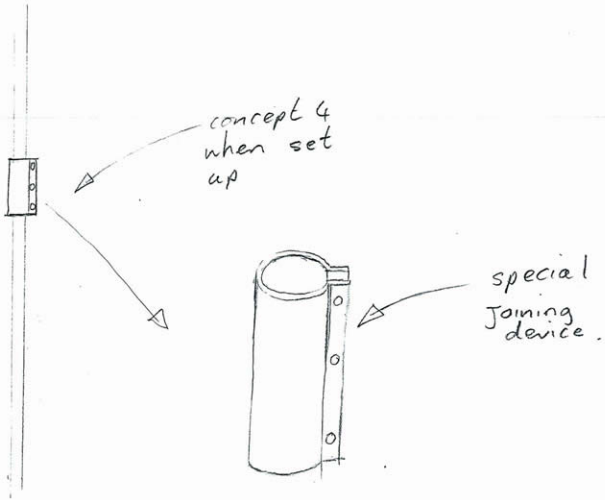
Tower Concept number 2



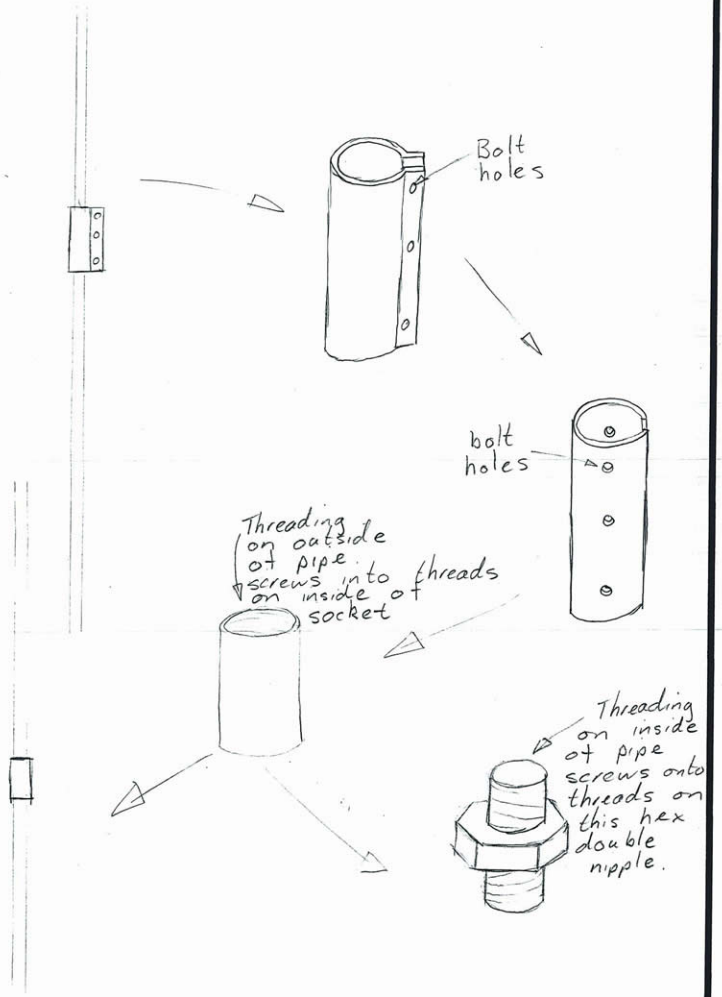
Tower Concept number 3



Tower Concept number 4

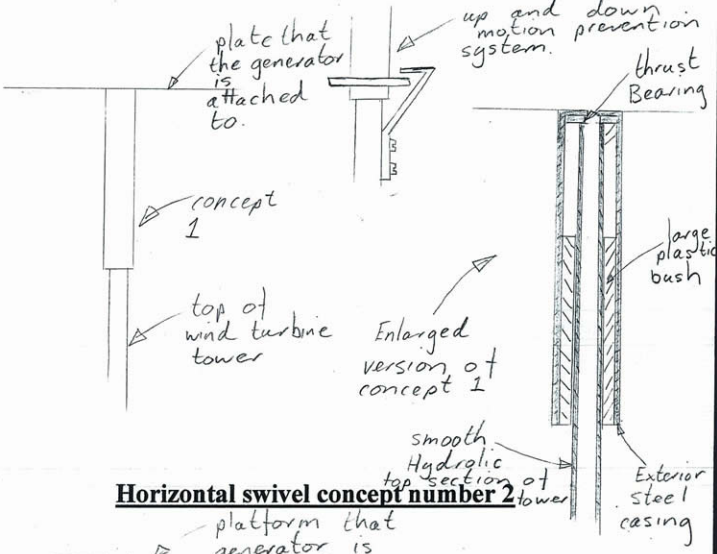


Tower Development

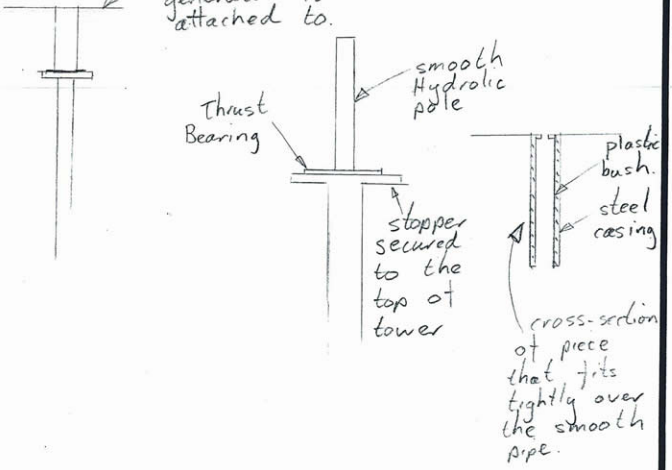


(Chosen method)

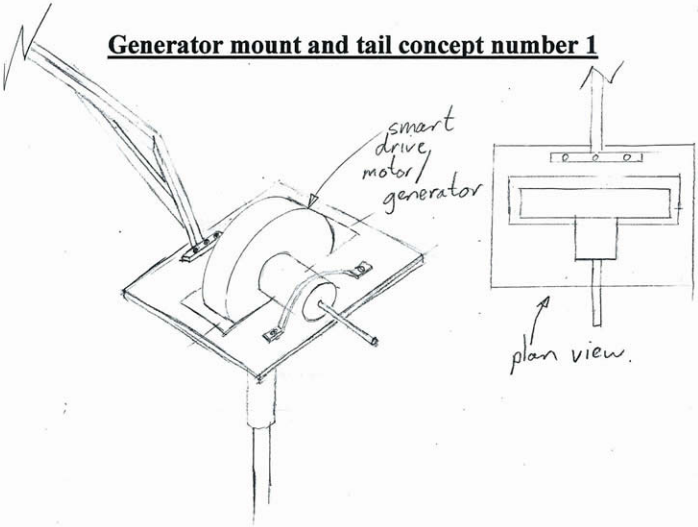
Horizontal swivel concept number 1



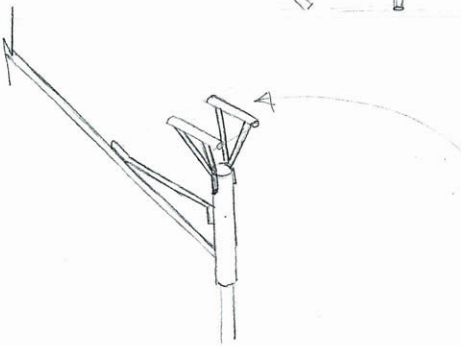
Horizontal swivel concept number 2



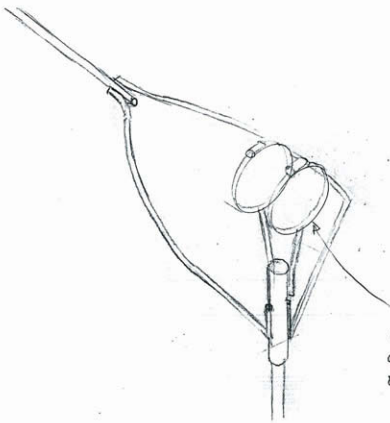
Generator mount and tail concept number 1

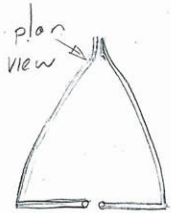


Generator mount and tail concept number 2



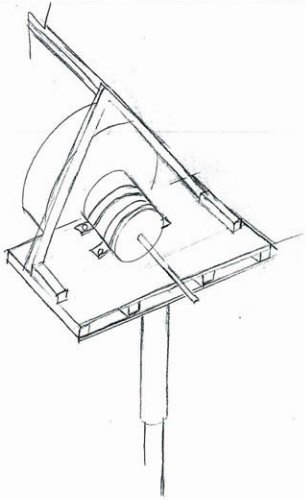
Generator mount and tail concept number 3



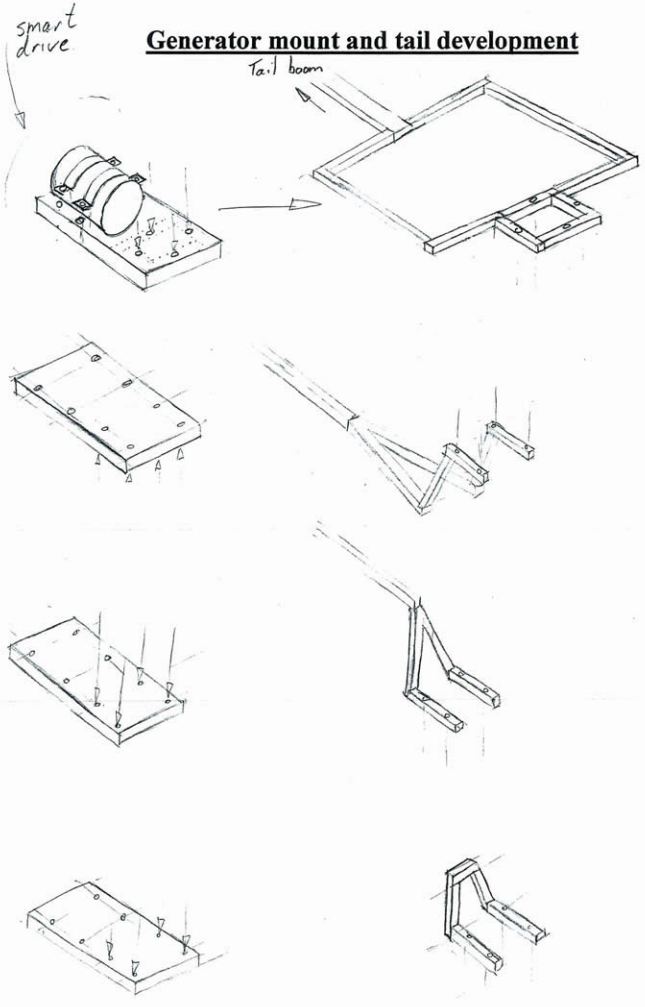


These are two heavy duty dubly clips which are tightened around the plastic bearing housing on the smart drive.

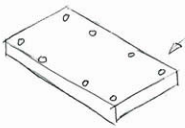
Generator mount and tail concept number 4



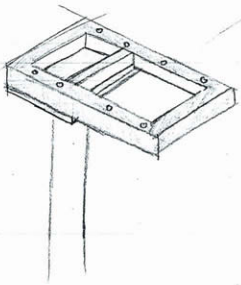
Generator mount and tail development

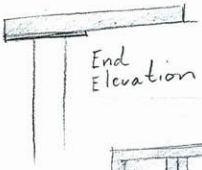


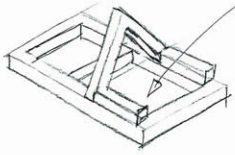
Generator mount Development

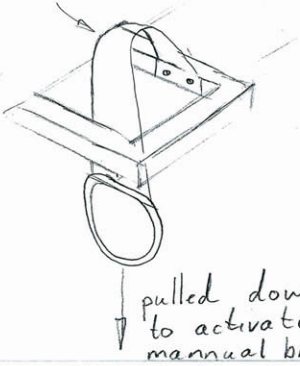


This is what I have so far. This would be too heavy.



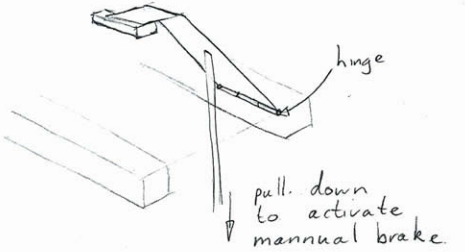


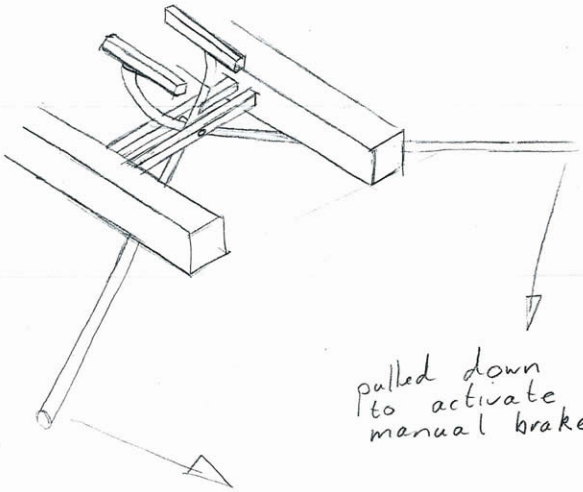




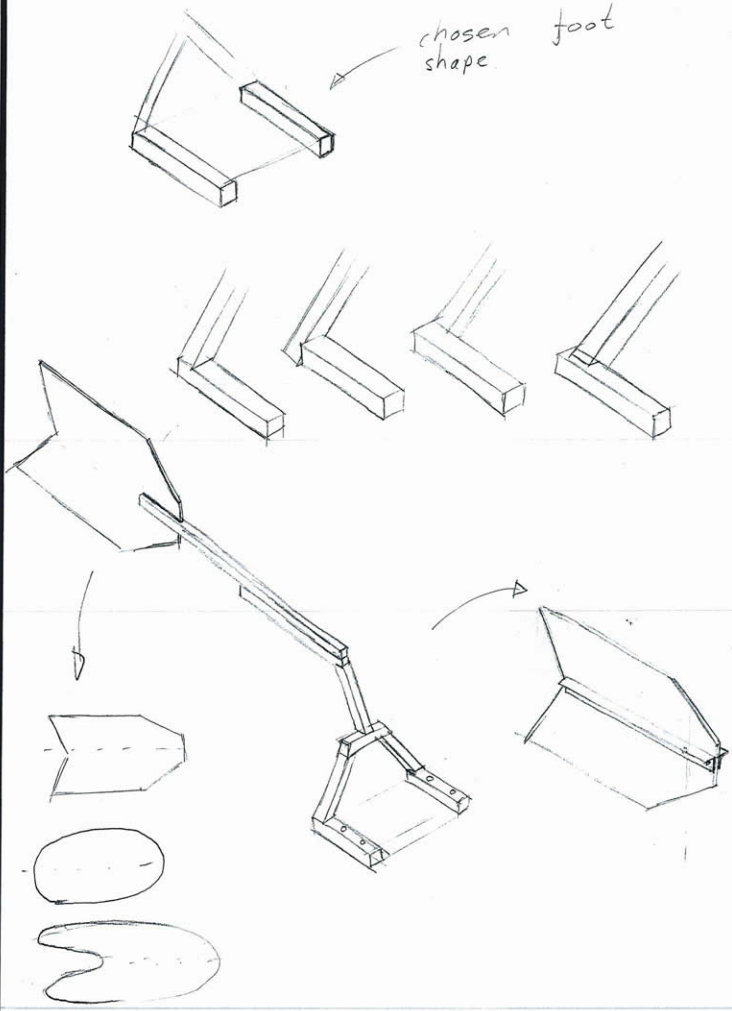
Generator mount Development

other possible solutions to the mannual brake:

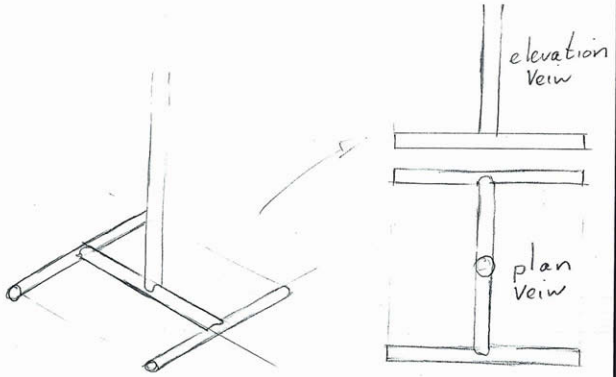




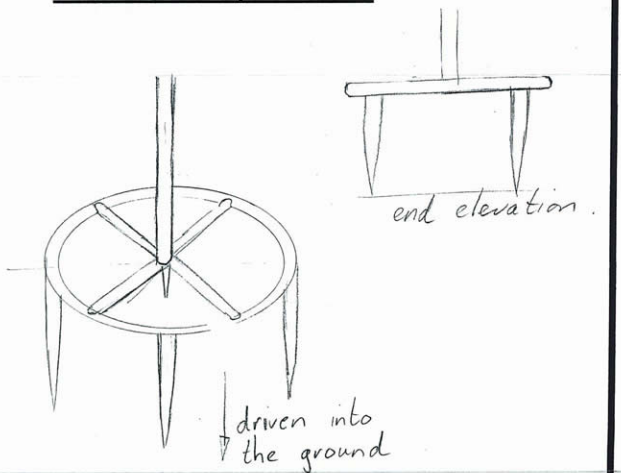
Tail Development



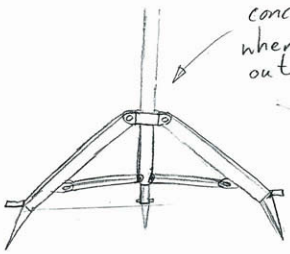
Base plate concept number 1

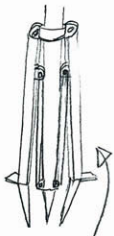


Base Plate concept number 2



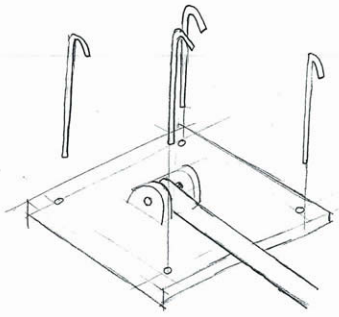
Base plate concept number 3





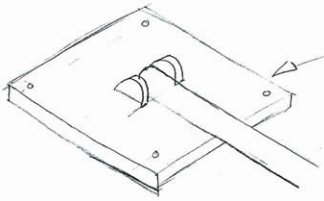
concept 3 when packed away.

Base Plate concept number 4

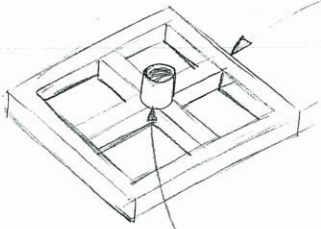


once the generator is attached to the other end and the base is secured to the ground, the pole can then be tilted upwards.

Base of tower Development



This base would be too heavy and too complicated with to many areas for possible breakage.

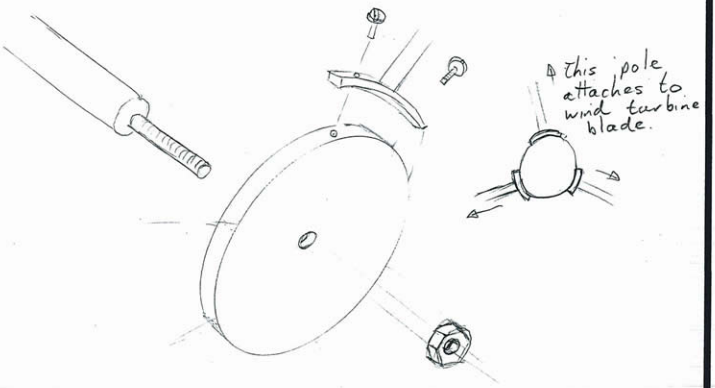


New base constructed from hollow box section.

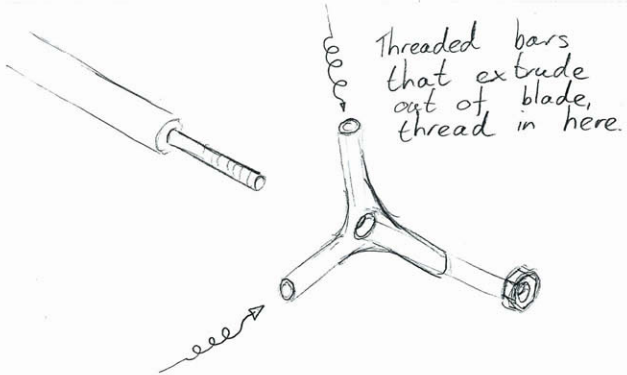
socket welded to midle of base. The tower screws into here.

How the blades attaché to the turbines axle

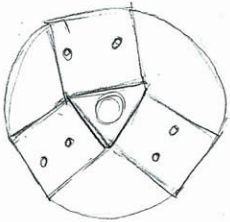
Concept number 1

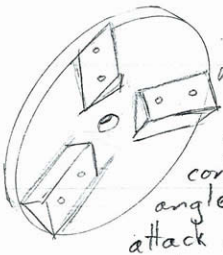


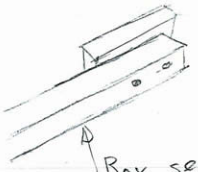
Concept number 2



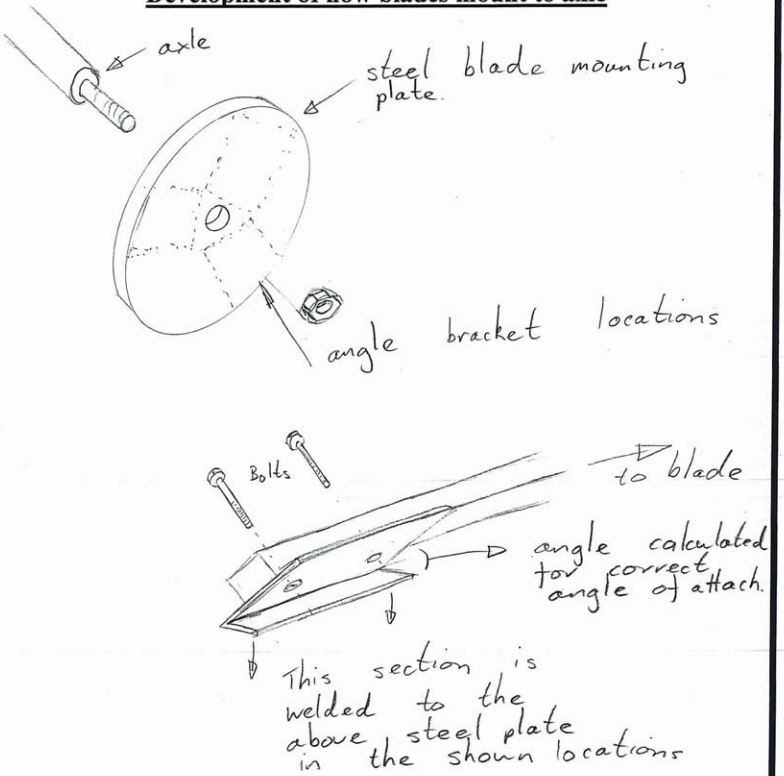
Concept number 3



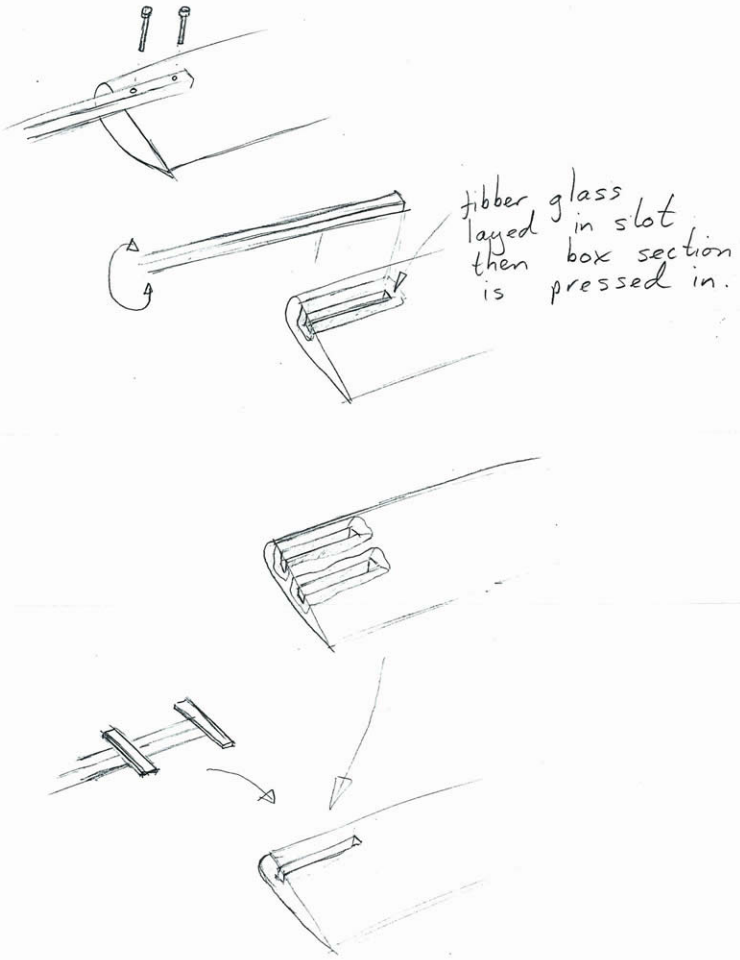




Development of how blades mount to axle



Development of how the steel box section is attached to the fibber glass blade



20/10/09 5:17:56 PM

Options

Clear definition of the issue to be addressed and the problems that require resolution.

I have developed each component relative to itself and to the other components to ensure that the whole wind turbine comes together nice and firmly. I will now, first present my developed designs to my client and when I have his approval I will construct each fully developed component.

Client consultation

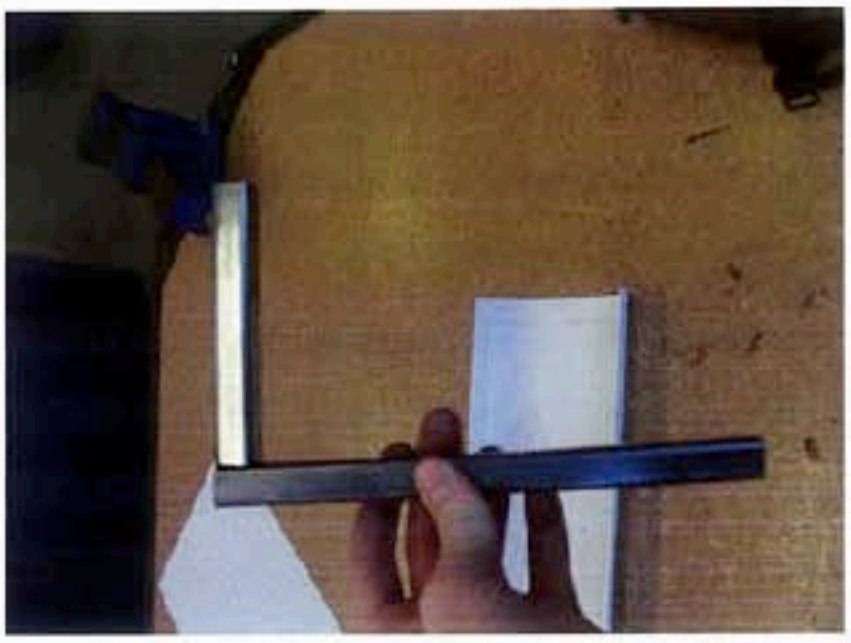
I have reviewed all wind turbine component design and give approval for the final design to start being constructed as it is exactly what I want.

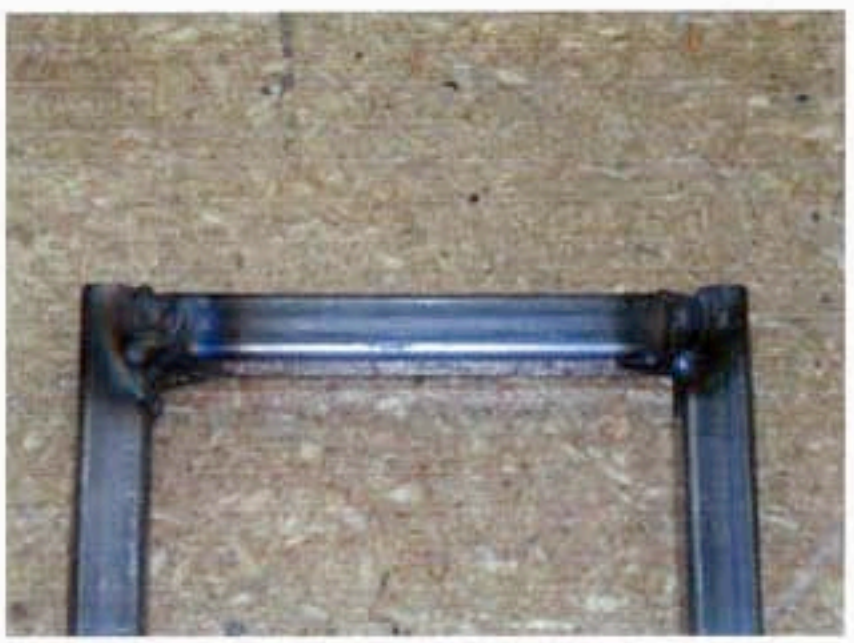
Signed Roy Anderson

27th July 2008

Construction of all the components of the wind turbine

The generator mounting plate





20/10/09 5:19:

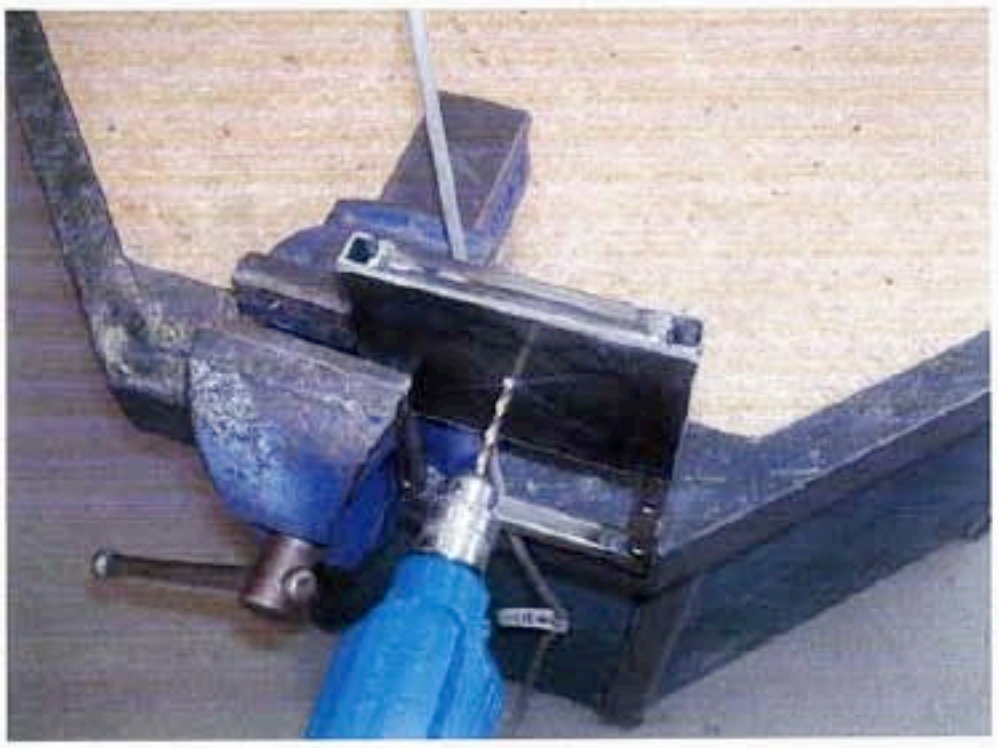
Options

Clear references into the portfolio evidence of having taken technological practice to resolve the identified issue.

20/10/09 5:19:50 PM

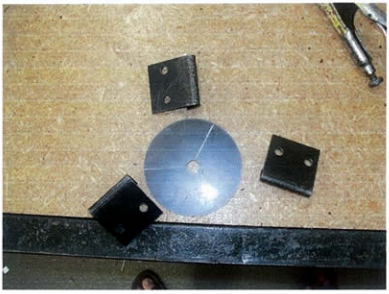
Options

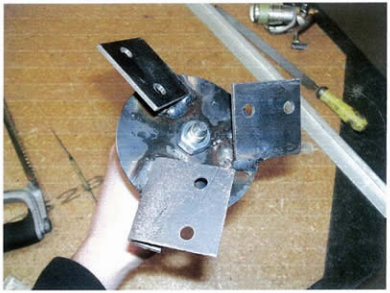
Investigation into relevant Codes of Practice and safety issues would enhance this portfolio.



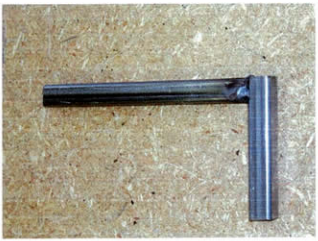
Drilling holes for tail legs feet to attaché to.

The axle bracket



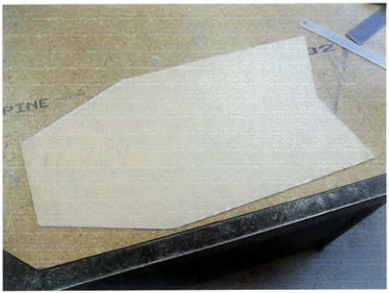


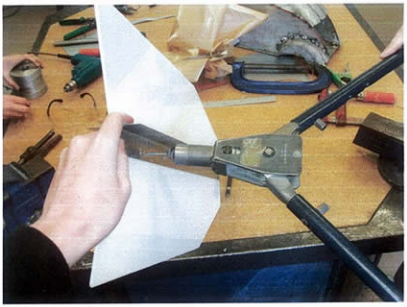
The tail boom and tail



Construction of tail boom and tail boom legs.

Building the tail





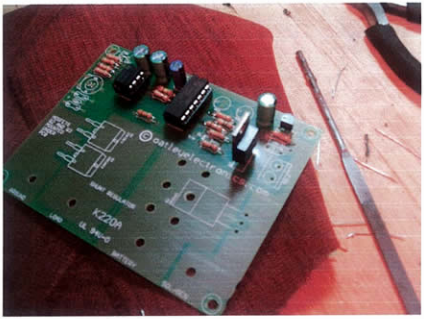
The base plate

Building the base plate and mounting socket to centre

Making the circuitry for charge controlling

Receiving the circuit board, which was ordered from Australia.

Components



Constructing the circuit board. This and other electronics, batteries and all wind turbine components will be packed into the main container.

The manual break

Assembly and testing of the entire project

This is the fully complete wind turbine. The cables, which come out of the bottom of the tower, then plug into the wind turbine container. In the wind turbine container there is the battery bank and all the circuitry needed so that the battery will charge automatically and when the battery is full, the charge controller diverts any more incoming current to a dump load situated out side the container.

20/10/09 5:20:42 PM

Options

There was opportunity here to better describe the process of developing, trialling and testing of the actual product.

The entire wind turbine folds down and fits into this easy to carry box, 30cm by 30cm and 1 meter long.

Final evaluation

I have now completed my project. I had to design a portable wind turbine that was efficient enough to, with average climate/weather condition, produce about 20 watts to charge a small battery bank. The device has been tested and it works very well. My design exceeds all design and I worked extremely hard to give my client exactly what he wanted. The project has taken into consideration so many different things, such as social implications, community aspects and affects, environment and daily consultation with client, teacher and engineer producing a project that everyone is very happy with.

My design meets specification number 1 because safety was the underlying factor in this project due to its social and community use. My design has an electronic switch for shutting down the whole turbine whilst lifting and lowering the tower. It has a manual break for control in high wind speeds. The tips of the blades are 1 metre above even the tallest of people making this whole device very safe

My design meets specification number 2 because I built the whole project for under $120.

My design meets specification numbers 3a and 3b because it is very durable and its operational noise is very low. The whole wind turbine has been built with a robust but light frame making it ideal for my clients intended use. Great measures were taken to make this wind turbine quite. For example it was considered during blade design, the blades where correctly balanced reducing vibration and therefore also noise.

My design meets specification numbers 3c and 3d because it is easy to pack up into a box, which is under the max space limit and is weather proof. The whole wind turbine can be set up or packed away in under 10 minutes, which meets the original goal. I have selected materials wisely and painted any bare steal in order to make the wind turbine safe from the elements. I have also covered up all electronics on smart drive using silicone.

My design meets specification numbers 3e, 3f, and 3g because it would be easily maintained and has been designed to be. It is as lightweight as possible and is under the max weight limit. The whole motor has been modified to make the wind turbine as efficient as possible and so it definitely meets specification number 3g.

My design meets specification numbers 3h and 3i. From wind data and calculated speed of blades relative to wind speed, the wind turbine should produce well over the required 20 Watts on average in Tauranga's average wind speed. The device also has automatic tuning into the wind systems on it so that it operates automatically and there for meets the last specification.

I am happy with the result and expect the wind turbine to work well in assisting my client with his initial issue.

Signed Kevin Anderson ..... K. Anderson .....

20/10/09 5:25:33 PM
Options

Critical reflection on understandings and the practice of others, across a range of contexts that were used to inform the development of the technological outcome.

Sticky Note 20/10/09 5:09:07
flewis
Options

Demonstration of elegance in terms of ingenuity, simplicity, optimisation and polish of the technological practice and its resulting outcome. The student demonstrated originality in terms of inventiveness, innovation and elements of unconventionality in the technological practice undertaken and its resulting outcome.

Client final evaluation

On the whole I am impressed and satisfied with how the project has turned out. Kevin has worked throughout the year with his advising engineer and teather to come through with a result that everyone is extremely happy with. I am very happy with the quality of work that Kevin has produced and I firmly belicve the device has thouroghly solved my issue.

Signate of satisfaction and completion of project

Roy Anderson

22nd October 2008

Sticky Note
flewis
20/10/09 5:09:07 PM
Options

It would have been helpful if the student had put a bibliography into his report to allow assessors to see evidence of resource development.