59 steps to be on air - by sun power

time of realization 24 h two persons

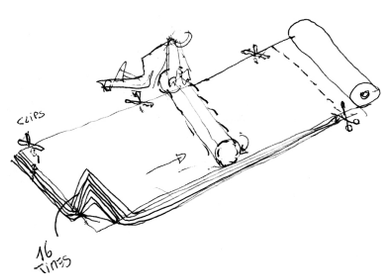
1 - Unroll a 20 microns thick black Polyethylene tube (usually used for garbage bags). The tube is usually folded and is 1,5 m wide. (3 m when unfolded) .

-You will need a total of 353 m long (one roll of 30 kg is usually 500 m long (100 €) Polythene black opaque high density (0,95))

1

2- Lie down 16 layers of plastic. Get rid of any air trapped between the layers. You need to unroll each one of them, one on top of each other, up to 22.25 m. Maintain the strips lined up together using clothes pins. The plastic is double, so you should have 32 layers.

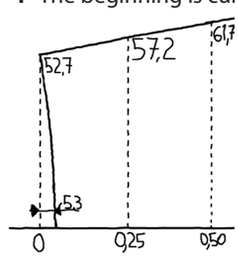
2



3- With a white pen corrector , draw a line every 25 cm on the edge of the plastic ...(they are a lot) ...then use the following numbers indicated below to mark the other line

Distance on the gore in m - 0,0/0,25/0,5/0,75/1//1,25/1,5/1,75/2/2,..... ..20,5/20,75/21/21,25/21,5/(last)21,75 1/2 width of the gore in cm - 52,7/57,2/61,7/66,1/70,4/74,6/78,8/82,8/86,7/90,6/94,3/97,9/101,4/104,8/108,1/111,2/114,2/117,1/119,8/122,4/124,8/127,1/129,2/131,2/133,0/134,7/136,2/137,6/138,7/139,8/140,6/141,3/141,8/142,1/142,3/1,3/142,2/141,8/141,3/140,7/139,9/138,9/137,7/136,4/134,9/133,2/131,4/129,4/127,3/125,1/122,6/120,1/117,4/114,5/111,5/108,4/105,2/102,1/98,9/95,8/92,6/89,4/86,3/83,1/80,0/76,8/73,7/70,5/67,4/64,2/61,0/57,9/54,7/51,6/48,4/45,3/42,1/39,0/35,8/32,6/29,5/26,3/25,0/25,0/25,0/25,0/25,0/(last)25,0

4- The beginning is curved.



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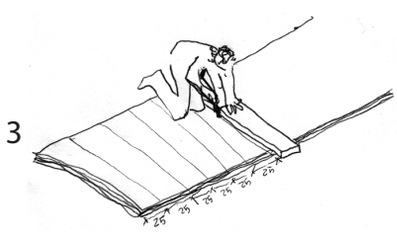

5- Cut the plastic pieces following the reference marks using a good welding iron (figure 2). If you are on the floor put a piece of plywood 5 mm thick underneath the cutting zone in order to avoid burning the floor. Line-up the ruler to 3 reference marks. Push strongly in order to maintain the layers squeezed together. Cut small segments while moving the ruler and the plywood.

Welding iron to cut ropes (you can find this in any place where they sell ropes)

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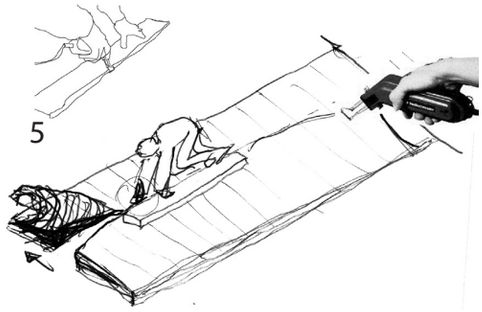
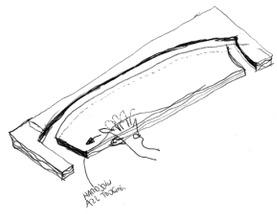


6-Hot cutting will also weld all the layers together.

7-Carefully separate the first layer from the others

6



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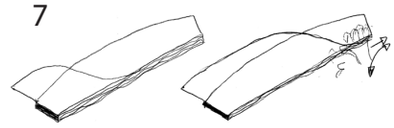
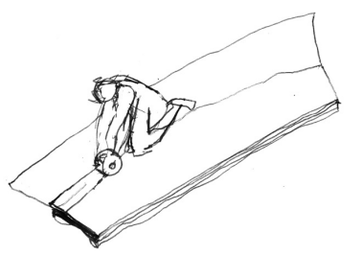


8- When you have opened the first layer place the tape along the joint (each joint is about 22 m long.)Warning ! you must stretch the plastic and make sure the surface is perfectly flat in order to keep the adhesive as close as possible to the welded joint . The tape must be of one piece. (22 m long) -3M tape transparent polyester or havane 3M Scotch Tape 351 : - 3M tape fibre glass reinforced (25 mm) 3M : ref. 8959.



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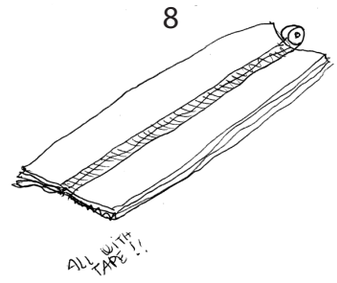
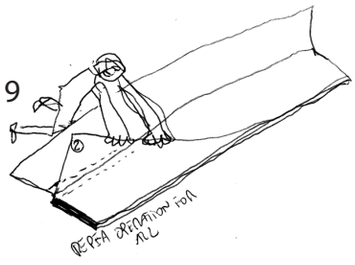
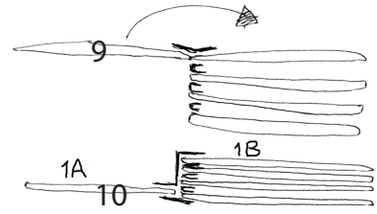


9- Unfold sheet 2 and tape it again. Continue that way until the last but one sheet. You have made 15 tape junctions. Make one junction less than the number of sheets

10- Go back to sheet 1 and tape between 1A and 1B.

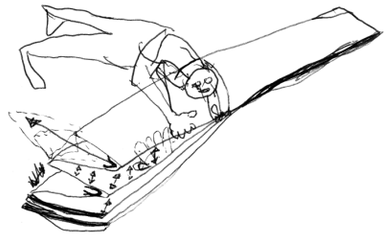
9





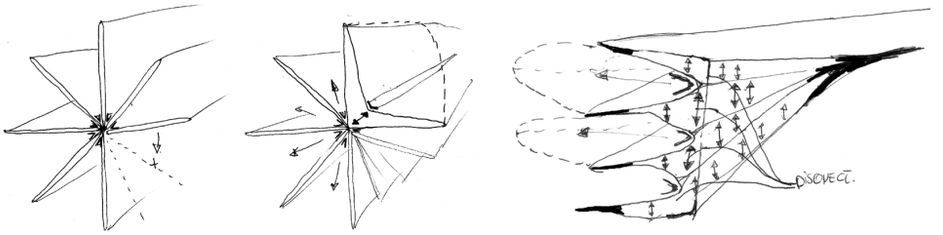
11-12- Separating the sheets -This is more difficult. Grab two sheet (both sheets are taped and reinforced) between your thumb and your index as close as possible to the joint and hold the joint with the other hand. Pulling slowly, the sheets should tear neatly from the joint while remaining assembled by the tape. Do it again cm by cm. It may happen that the black plastic tears off, if so put it back on tape and go cautiously.

11

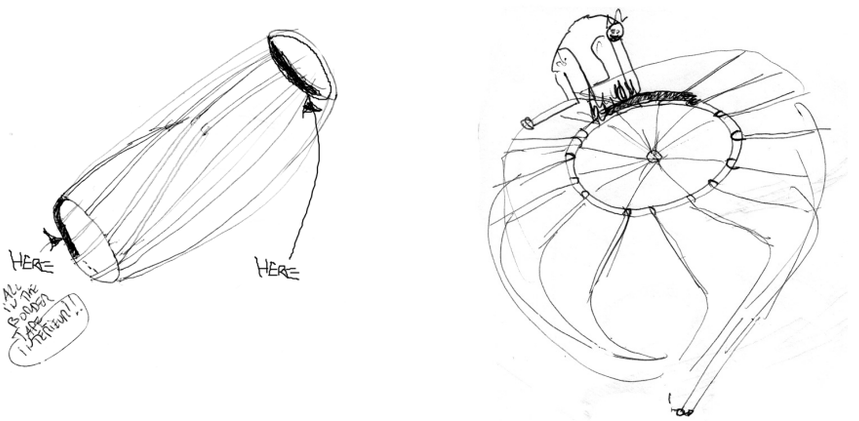


12 - As soon as the first layer sheets are separated of the main joint on 1/2 meter long, do the same with the other sheets. Continue so from 1/2 meter long to the next 1/2 meter. There is .352 m to tear off, but it must be done slowly, neatly and the closest possible of the joint. Go by short length pulling inside out the balloon.

12



13- To reinforce the bottom and top of the balloon, use the following process

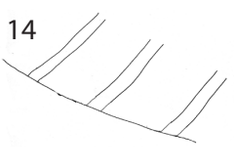


14- You have this

15- To reinforce the edge of the balloon put one adhesive tape inside the envelope following the edge

16- Put a string over the tape

14



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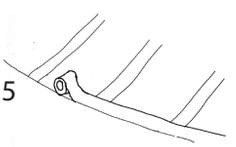

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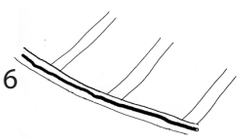
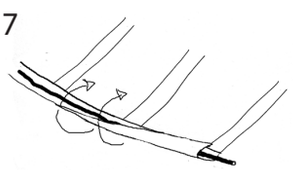


17-Fold back the taped edge of the balloon over the string

18-Put again one adhesive tape halfway over the envelope and the folded part.:

17



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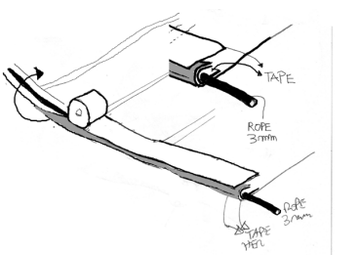
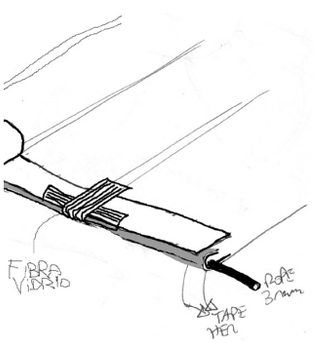


19-Then place a reinforced tape as you see in the drawing

19

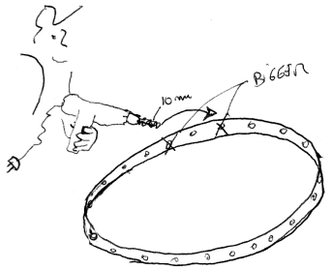


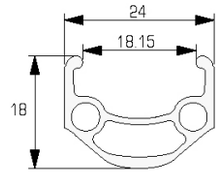
-2 mm diameter rope (nylon, polyamide or polypropylène (100 m long)-3 mm diameter rope (nylon, polyamide or polypropylène (100 m long) -Fibre glass reinforced tape (25 or 50 mm wide) (3M : ref. 8959.)

You need two bike wheel rims

20- Enlarge 8 holes of the wheel rim with a 10 mm drill to hold on the 4 handles

20

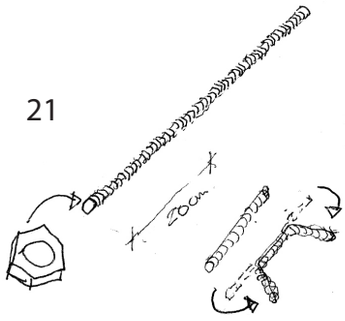




Mountain bike wheel rim (T224) 36 holes : 25 € T.T.C. If you are unable to find this model, take the one with the larger diameter+a deep wheel rim (see drawing) + holes for the spokes with smooth edges washers. Important: the inner dimension of the wheel should be wide than the clamping ring

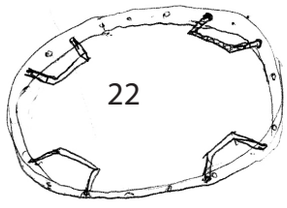
21- Cut the 5 mm diameter stick into 4 pieces of 20 cm each, bend them

21



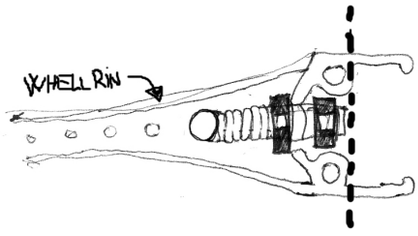
22- Fix the handle to the wheel rim with nuts (see drawing).

22



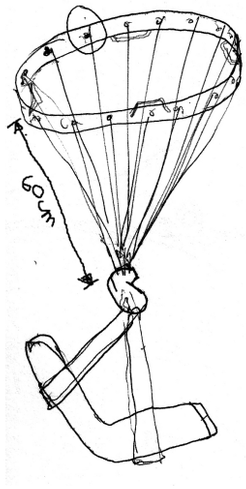
23- Make sure that the stick doesn t stand out the dot line on the drawing. For security, glue the nuts

23



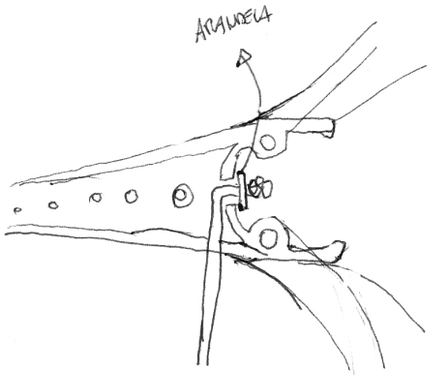
24- Get a children chair and a safety harness (see picture)+gliding hook to attach the flying machine. Hang the wheel rim horizontally up to two meter high from the ground, then you can easily place in every hole one string - Each string should be 60 cm long

24



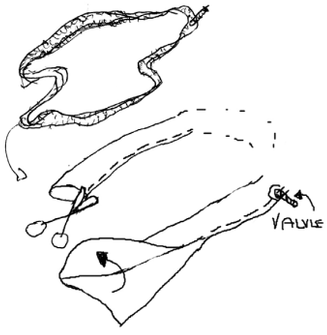
25- Place a washer in each string and make a knot (see drawing) load the chair with 2 kg and make sure all strings have the same tension (don´t get mad ...it will take you some time). Cut and burn the rest of the string for more security, then glue the knots to block them up entirely.

25



26- Take 2 bicycle tubes as large as possible and open with scissor all the inner perimeter (at the same high of the valve). Remove the valve - (Inner tube for a standard 26 inches mountain bike wheel is OK.)

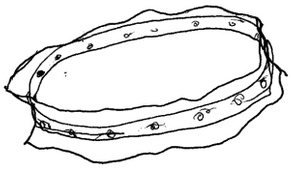
26



27- place the first bicycle tube around the wheel rim,

28- put the envelope on top

27



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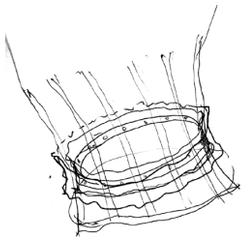
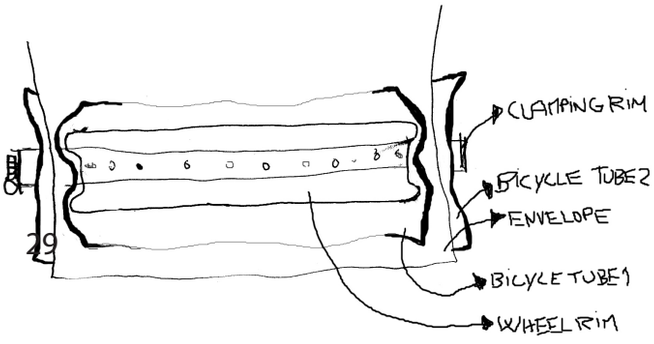


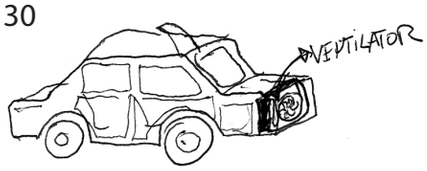
29- Now take the second bicycle tube and put it around the (envelope + 1 first inner tube+wheel rim) Place the clamping ring around it and tighten.
Rustproof 3 m clamping ring (14 mm wide)



29

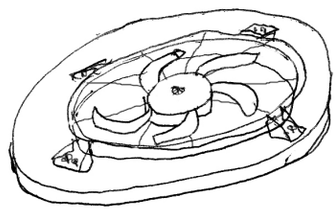
30- Get a car radiator´s ventilator (a second hand ventilator is fine) Choose a powerful one (45 to 55 €).

30



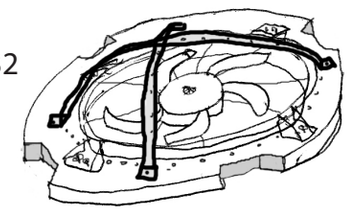
31- Take a wooden plate 70 x 60 cm (8 mm thick), cut it off to fit the size of wheel rim, make a central hole for the ventilator,

31



32- Make some cut in the borders of the wooden plate in order to be able to reach the handles. Fix the ventilator to the wooden plate. You may cover the ventilator in order to protect your hands.

32



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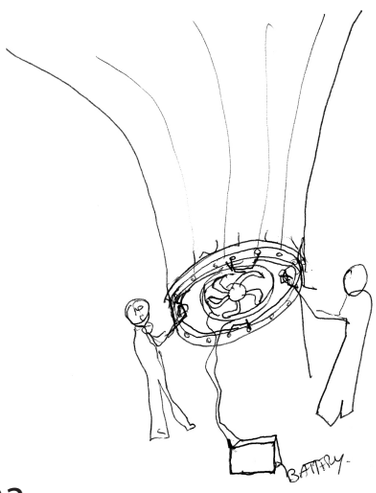
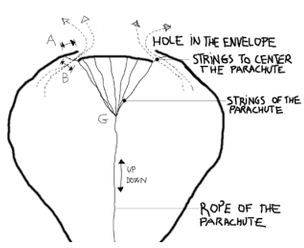


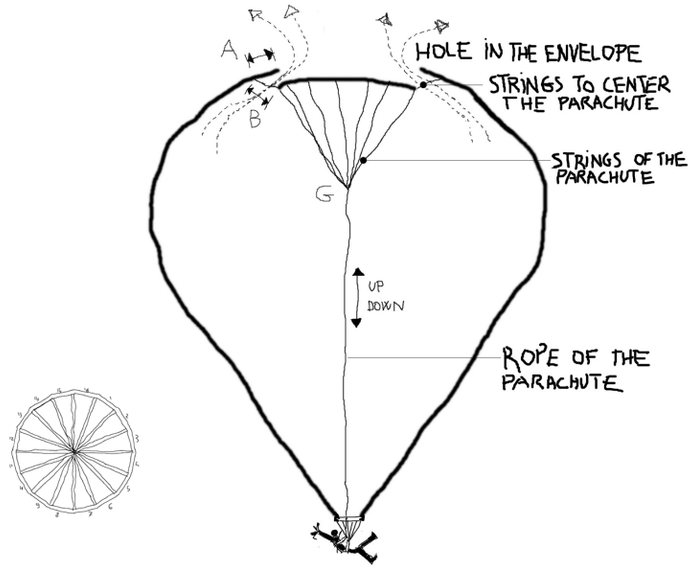
33- Any low capacity 12 volts battery

.34- In the upper hole of the envelope, (at the opposite side of the wheel rim and chair) you will construct the upper part of the solar flying machine which looks like a parachute .
One string (H) is connecting the centre of the parachute to the upper part of the envelop and the second rope (H1) goes down to the chair

34

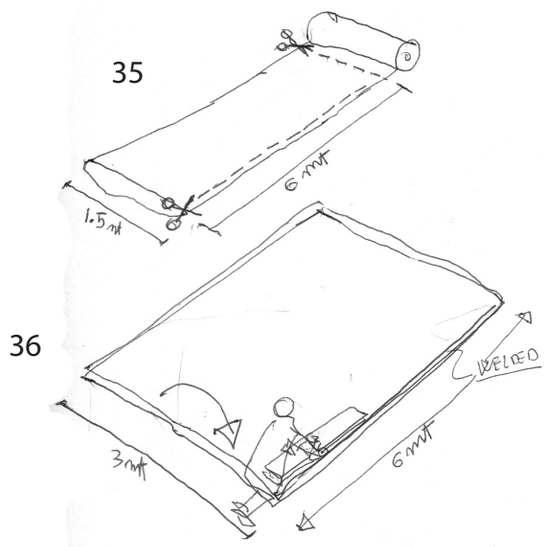


The parachute function is to open and close the hole at the upper part of the envelope.
The parachute is carried up by the hot air blocking the hole of the envelope.
-By pulling the rope the hot air is released making the flying machine going down
(This will also be helpful when you later want to fold the flying machine).
The parachute radius (A) is 25 cm wider than the envelope hole (the parachute diameter is 50 cm wider than the envelope hole).

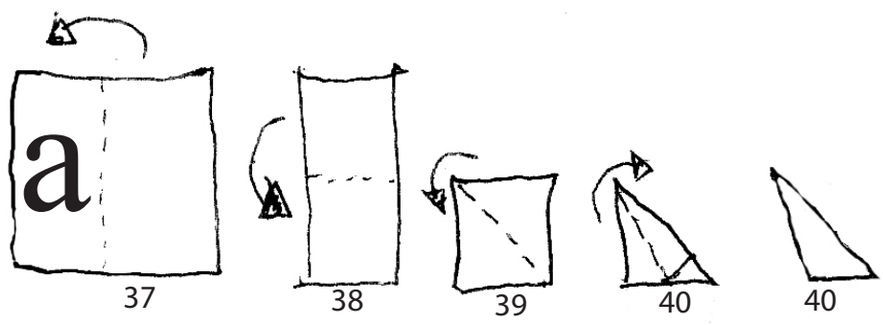


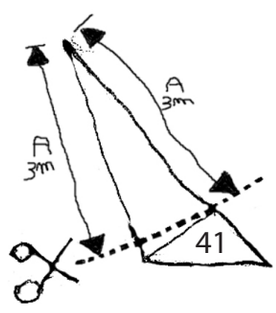
35- Unroll a 20 microns thick black Polyethylene tube (usually used for garbage bags). The tube is usually folded and is 1,5 m wide. (3 m when unfolded)

36- Lie down 2 layers of 6 m long black Polyethylene tube, Open them, they you will get two 3x6 m surface. Join them together with the welding iron. You will obtain a 6x6 m square.



37- Fold in the middle, 38- fold it again (you should now have a 3x3 m rectangle). 39- Fold in diagonal 40- Fold it again in diagonal





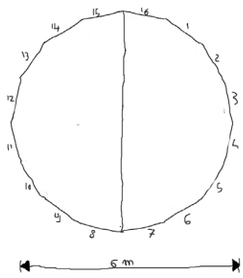
41- Measure the 3 m side and mark in the opposite side the same length (3m)

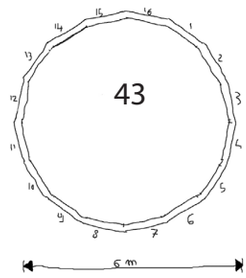
Draw a line between this two points and cut off the remaining part.

42- Unfold it and you will have a 6m diameter polygon with 16 sides

43- Reinforce all the perimeter of the polygon at the border (all each 16 sides)

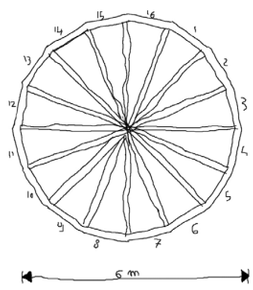
42

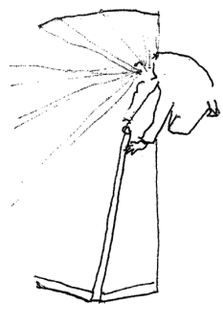




44- Reinforce the parachute with 8 strips of tape dividing the polygon in 16 parts....this will prevent tearing. (The first tape should overlap the welding joint)- Beware: the tape you use should be in one piece!)

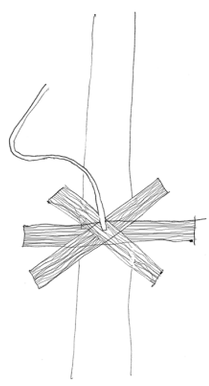
44





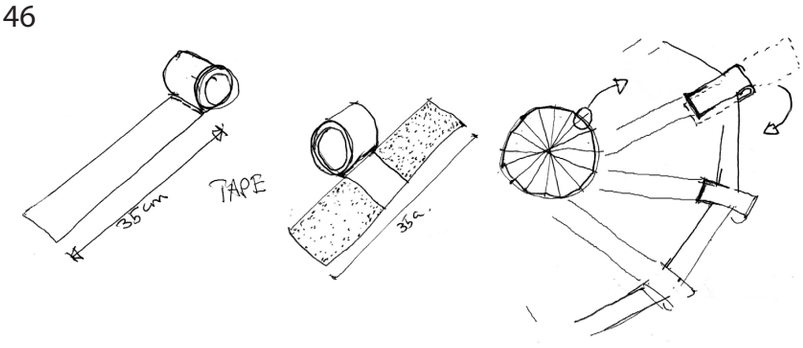
45- Cut a rope of 2 mm x 40 cm long, Make a hole in the centre of the parachute Pass the string through the hole and fix it with the reinforced tape in the inner side of the parachute.

45



46-Prepare 16 ribbons and tape them to the corners of the polygon as shown in the drawings.

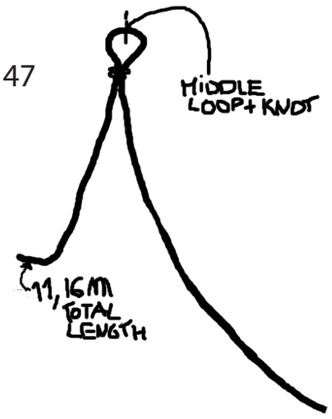
46



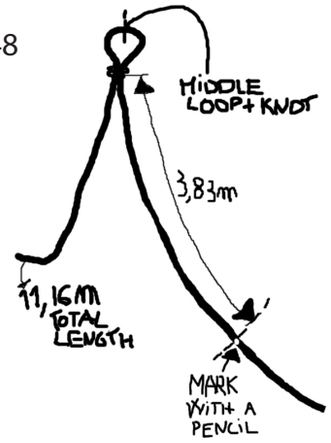
47- Cut eight 2 mm strings, long 11,16 m. Fold each string in the middle and make a loop. (the loop will later be used to slide another 20 m long string (3mm diameter) in the hole)

48- Mark the strings with a pencil at a distance equal to 3,83 m.

47

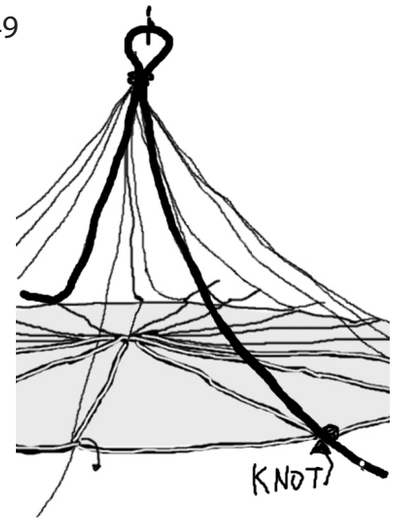


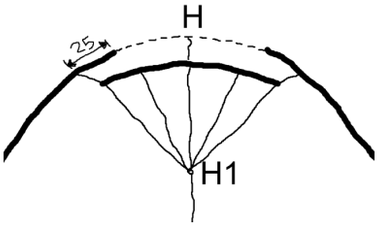
48



49- Take one of the parachute strings. Make a knot so that the mark is at the level of the strap loop. Tight up the knot. Repeat the operation for every string. Beware : the parachute strings must NOT cross each other!

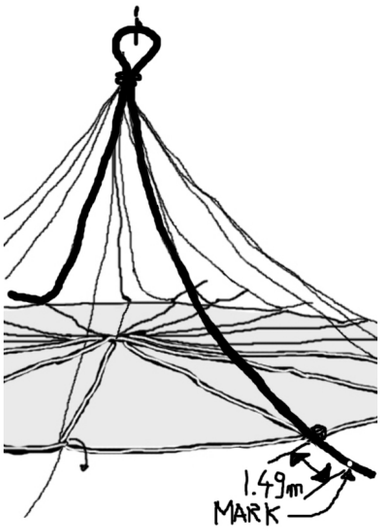
49





50-Mark each string on a distance equal to 1.49 m measured from every vertex of the polygon shaped parachute.

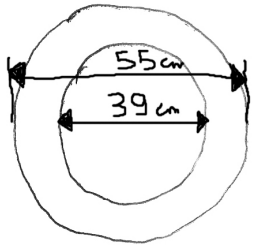
50



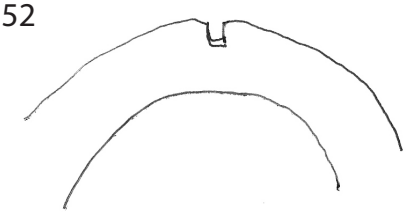
51- Get 20 curtain rings
The rings will help fix the parachute strings to the envelop and distribute the tensile stress on a wider surface

52- Make two small incisions in each ring with a file (diametrical opposed one to each other)

51

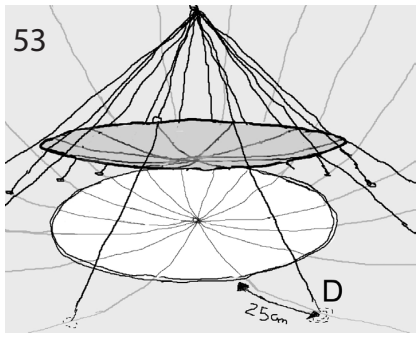


52



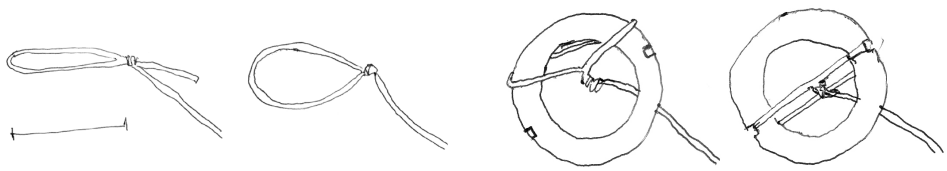
53-Blow up the envelope upside down (the upper part is now on the ground) and put the parachute inside the envelope -Attach the strings used to center the parachute to each summit of the envelop
Mark 16 times the envelope on each taped joint on a distance equal to 25 cm (point D) (this is the overlapping of the parachute)
Reinforce the point D with glass fibre tape (see point 49)
and make a hole, pass through the hole one of the centering strings of the parachute.

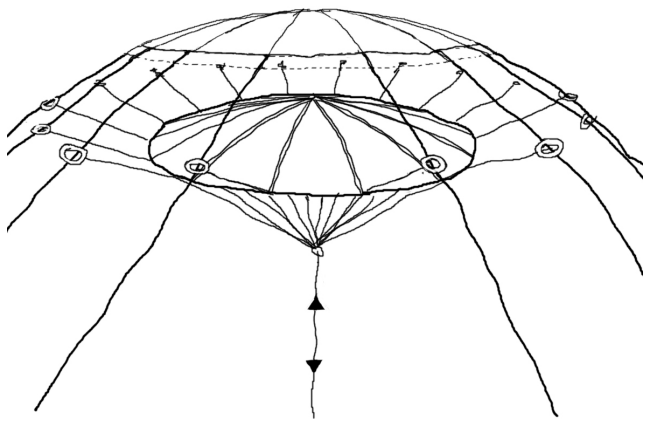
53



54-Make a loop with the string on one of the 16 marks and then make a knot.
Cut the rest of the rope, and melt it to block the knot.
-Place the string into the ring and fix it to the incisions.

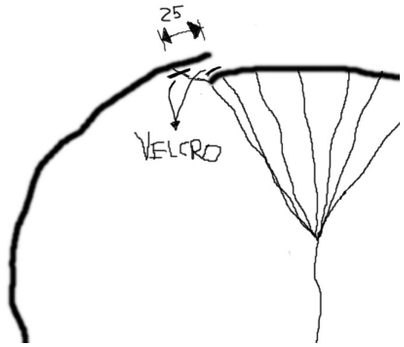
54





55-Fixing the parachute to the envelope to keep it closed during the blowing up !
Glue 16 pieces of 4 cm long velcro on the angles (taped joint) of the envelope at 25 cm from the border of the hole.
And 16 pieces of 4 cm long of velcro on the strap loops of the parachute.
Mark with numbers from 1 to 16 each joint (to avoid confusion)
The version shown above is an easy version... based on the research of my frind L. Besset (http://perso.wanadoo.fr/ballonsolaire/index.htm) and others.... but with the same principles and materials you can bild more complex ones.....

55



Now..... ready to fly ! ...

Since this flying machine is lifted only by the sun !
You imperatively need a sunny day with no wind at al
l.....see you on air

56

with friends...

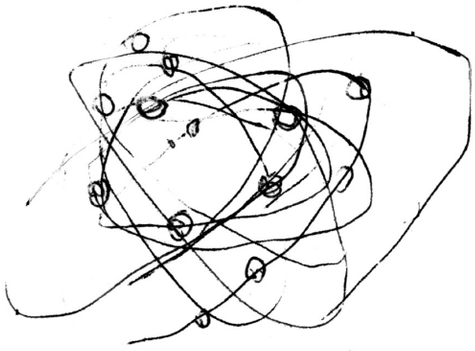
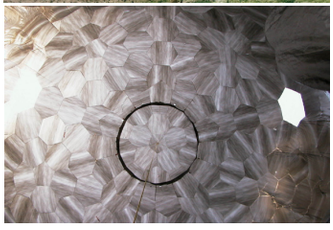
57

already shaping the new continent ..

58

a new planet...
looking for an orbit

59



The version shown above is an easy version... ... but with the same principles and materials you can build more complex ones.....
Down, our sample..... .the first geodesic solar flying machine of the world .....