Building the All Season Solar Cooker

Thanks for your interest in the All Season Solar Cooker (ASSC). What follows below are step by step instructions that will help you to be successful in your first effort to build this cooker.

Materials: I build all my ASSCs using 4mm corrugated plastic sheets. These sheets are rigid, are easily cut with a utility knife. This corrugated plastic is available in 4’ x 8’ sheets. You can get two ASSCs from one sheet of corrugated plastic. (you cannot get one ASSC from a half sheet – buy a full sheet) The plastic is made from the same stuff as milk bottles. It is called polypropylene or PP. It is very durable, impervious to moisture, and, once lined with foil, can handle the heat of the cooker. Best of all, you can recycle your scraps.

I have used other types of corrugated plastic, such as corrugated polycarbonate sheet, but find that the hinges break after only a few uses. Please use the polypropylene. (PP)

Although I have never used corrugated paper, I think it would work as well as the PP. If you choose corrugated paper, please use virgin stock. That is, find a sheet of corrugated paper that is large enough so that the entire ASSC can be laid out and folded without using tape to make hinges. Why? The reflector array relies on hinges that are integral to the material in order to have the stiffness that it needs to maintain its shape. If you use tape hinges or mechanical hinges that are not integral to the material, the stiffness of the hinge will be greatly variable and the reflector array may not hold its shape without additional support.

If you choose to use corrugated paper, buy high quality. Find twin wall if you can. It costs about as much as the corrugated plastic. If you choose to use corrugated paper, be sure to treat your finished ASSC for moisture protection. You should paint the outside of your ASSC with a good moisture proof paint.

When properly used, the ASSC is minimally exposed to cooking steam. Unless you spill, the ASSC is minimally exposed to moisture. Most of the moisture problems with corrugated paper will occur due to the environment – rain, dew, high humidity.

A final word on materials: The dimensions are for material that has a thickness of about 3/16 to ¼ inch. If your material is thicker than ¼ inch, you will have to make some small adjustments to the drawing so that the cooker assembles and adjusts properly.

The next important material is the covering. I use aluminum tape. Commonly known as metal repair tape, I find this material in the heating and air conditioning section of my local hardware store. There are a number of choices. The one I like best is the (lucky me) least expensive. Two brand names – Nashau 322 (home depot) or Shurtape 912 (Lowe’s) both have an excellent adhesive and are very shiny.

I like the aluminum tape because it can be polished if it becomes dull.

You can also use aluminum foil. The trouble with aluminum foil is that you will need to use a very noxious adhesive – contact cement – to get it to stick to the PP. If you choose cardboard, you can glue the foil to cardboard using non-toxic white glue. In every case
where you use the aluminum foil and glue, it will wrinkle after a few uses. The tape will also wrinkle, but not nearly to the extent as the foil. The wrinkles will not affect the performance of your cooker.

Hardware:
You will need carriage bolts
Number: 6
Length 1” or 1.25”
Size 1/4”
Hex nuts
Number: 8
Size 1/4 “

Why 8 nuts and 6 bolts?

The upper reflector panel wings fold INSIDE the side reflectors. When so configured, the notch in the side reflector panel will align with the hole you will use to attach the elevation bar. Place a carriage bolt through the hole in the upper reflector wing. The bolt should go from inside the cooker to outside. Next, attach one hex nut to this bolt. The nut acts as a spacer, taking up the space created by the notch. It is not absolutely necessary but it serves to improve how the parts move together when you adjust the cooker.

This extra nut is used only for the top reflector panels. The lower reflector panels are folded to the outside of the side reflector panel and only get single bolt with nut combination to attach the elevation bar.

Drawing the cooker

Minimal tools – measuring tape, straight edge at least 36”, pencil
Optional tools – 4’ t-square, aka drywall square. These are found in the tool departments of home improvement stores.
Square your material.
If using the corrugated plastic, you will need to square your material. The corrugated plastic is almost always out of square – so says the manufacturer’s web site.
Using the drywall square so that the “T” is parallel with the corrugations, draw a building line close to the left edge of the material. Start at about 1” from the left at the bottom, with the drywall square. You will see just how much out of square your material is. I have seen up to ½ inch out of square on the PP.

Layout
Measure from left to right along the bottom building line and place tic marks at 6” and 36”.
Using the T square or measuring tape, measure up from the 6” mark and place a dot at each of the points labeled in bold on the drawings. Label the points. Repeat this for the 36” mark.

Using a straight edge, connect the dots on the 6” line with the dots on the 36” line. You will wind up with a set of parallel lines as seen in the drawing.

Starting on the bottom building line (which is the bottom edge of your material) and measuring left to right from your left side building line (NOT the edge of the material) place a mark at each point listed for that line. Example, the 2.25” line gets marks at 14.25” and at 38.75 inches.

The marks on the parallel lines have now become coordinates. Carefully label each coordinate. Check your work to ensure that you have included every coordinate shown in the drawing.

Connect the coordinates as shown.

Pay attention to the areas marked A, B, C, and D. Here they are blown up. Just be sure to notice that areas a and b there are 3 intersection points – not one. For areas c and d there are two intersection points, not one or three. If you mark and label your material according to the plans, you will be OK.

This is where I have offset the folding hinges of the cooker to compensate for the thickness of the material. If you use a material thicker than ¼ inch, you will need to move the offsets.

Cut and fold the cooker.

Cut the heavy lines and fold the light lines.

All horizontal folds are both inward and outward. This is for adjustability and folding. All vertical folds and the diagonal folds for the upper and lower reflector panel wings are inward.

The folds marked E and F are outward.

To make a fold in plastic or cardboard, place a straight edge along the fold line, then, using the edge of a Phillips head screwdriver, score an indentation in the top surface of the material. Avoid puncturing the top surface. Then, leaving the straight edge on the material, hold one hand on the straight edge, applying pressure, and lift the other side of the fold. You should get a nice, clean fold along your score line.

Punch or drill the holes.

Assemble the cooker.
Your cooker is mostly laid out but you need to punch a couple more holes. In this next step, you will partially assemble the cooker, and then mark where these last holes will go. Fold the cooker as shown, then, using an nail or other sharp, narrow, object, punch a guide hole through the assembly tabs. The hole should be about 1” back from the front edge of the small assembly tab. Repeat the process on the other side of the cooker. Unfold the cooker and punch or drill the holes that you marked.

Covering
There are several choices for covering. My current favorite is to use aluminum tape. I use either the ShureTape 912 (Lowe’s) or Nashau 322 (Home Depot) or Duck aluminum repair tape (WalMart). All of these will stick very well to the corrugated plastic. You can also use aluminum foil and white glue – but your bond will not be nearly as strong.

Technique for taping. (Please download the folding and covering instructions)
This is best with a team.
Without removing the backing, cut a length of tape that will overlap by about one inch on each end.
Carefully peel back about one inch of the backing, and then apply the tape at your starting point. Have your partner hold (or use a clamp such as a clothespin to hold) the trailing edge of the tape where you intend for it to attach.
Slowly pull the backing from underneath the tape while using your hand to gently smooth the tape onto the plastic.
Each subsequent strip of tape should overlap its neighbor by 1/8 inch.
Proceed in this manner until the cooker is covered. Covering the assembly tabs is optional.
Once the cooker is completely covered, use a rolling pin or similar object to roll the tape smooth. This will improve the strength of the bond.

Reassemble the cooker.
See the drawings.
Attach the sunsight.

Using the cooker.
About solar cooking.
The amount of food that you can cook depends upon the size of your cooker. Regardless of design, any solar cooker can only collect and use the amount of light that is available to its insolated surfaces. A solar cooker with an insolated area of 1000 square inches has much greater cooking potential than a solar cooker with an insolated area of 500 square inches.
You have just built a device that is capable of efficiently capturing incoming sunlight. Success, however, is in the hands of the operator. If you start too late, overload the cooker, or otherwise do not collect enough sunlight to do the job, you will be disappointed.
On the other hand, if you take full advantage of the features of the ASSC — starting early, managing focus, not overloading the cooker, you will be very satisfied with the results.
Please follow these two basic rules until you become more familiar with your cooker’s capabilities:
1. Start early – I am cooking as soon as the sun comes up. You should start no later than 9 am or as soon as the sun is available.
2. Start small – use a two-quart container, or smaller, when in the winter position. Use a 3 quart container, or smaller, during the best summer conditions. I can get a whole chicken in a two-quart pot.
Get a few successes under your belt before you move on to the more challenging foods such as dry beans.