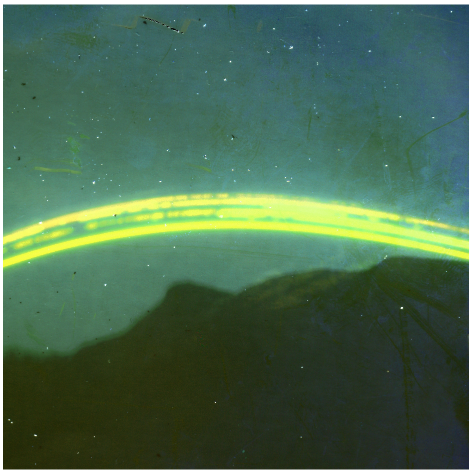
http://www.edinburghlofi.com/misc/solargraphy.pdf

Solargraphy



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Solargraphy

(From the latin - solar, of the sun and graphia, writing.)

A solargraph is a long-exposure photograph which shows the path taken by the sun across the sky. Solargraphy uses a simple pinhole camera containing photosensitive pa per, securely fixed in a position which will not move or otherwise be disturbed. The long term pinhole exposure is made tracking the sun over a period of months, separate light trails form as the sun's elevation changes relative to the northern hemisphere of the earth, as it travels from its furthest in winter (perihelion) to its nearest in summer (aphelion) .

Solargraphy is a 'printing out' process. This means that the light has to provide all the energy required for the silver halides (salts) on the photographic paper to change to a visible state. When the grains of silver halides on the black and white photographic paper are exposed to light, a few atoms of free metallic silver are liberated. These silver atoms form the latent image. Usually this latent image is then developed using solutions that reduce (adding an atom to enable the salt to split into its original parts) silver halides in the presence of free silver atoms. An 'amplification' of the latent image occurs as the silver halides near the free silver atoms are reduced to metallic silver.[1] In solargraphy no development is done using additional chemicals to amplify the process, so all of the image must be present as light converted silver atoms on the paper.

As more light is allowed to fall on the paper, over the prolonged exposure period, coloured areas form. This is caused by silver atoms clumping on the silver halide particles. As more free silver is liberated by the light energy reaction the 'print out' on the paper becomes coloured. First appearing yellow, then sepia, then red-brown and finally as a slate-gray shade as the clump particle size increases.[2]

This image may then be scanned to form a digital record. Silver halides remain on the paper where full conversion to exposed silver has not taken place. In a traditional darkroom paper process these would be removed using a fix chemical solution but this may not be possible with solargraphs due to the bleaching action of most readily available fixes. This means that further exposure to light can completely blacken the solargraph image so they must be stored in complete darkness and only a limited number of scans may be made of the image.

Characteristics

- Track of the sun across the sky.
- Missing tracks / dot and dash tracks due to clouds over the sun.
- Stationary objects.
- Colours caused by silver halide particles reacting to light and transforming to clumps of silver atoms, the reds and browns of the negative inverting to 'natural' greens and blues in the positive (although there is no direct correlation between the actual colour in the scene and the colours formed by the solargraph image).
- Canister movement ghost edges caused by elements, birds, loose fixings.
- Moisture specs and trails.
- Photographic paper degradation from prolonged exposure to the elements.

1 http://en.wikipedia.org/wiki/Gelatin_silver_process
2 http://www.eso.org/sci/publications/messenger/archive/no.141-sep10/messenger-no141-43-45.pdf

Background

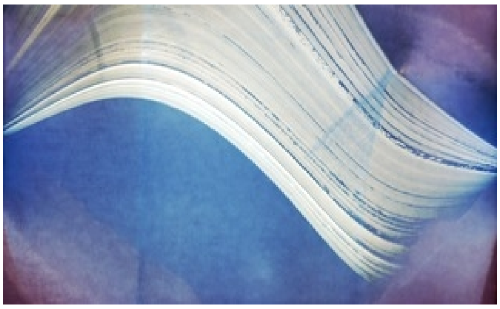
The solargraphic technique using photographic paper originated from experiments made in Poland around 1999-2001 by, the then students, Slawomir Decyk and Pawel Kula, and Diego Lopez Calvin (Madrid). Others working at the Academy of Fine Arts in Poznan and Stettin - Konrad Smolenski, Wojtek Hoffman, Przemek Jesionek- were also experimenting similar techniques at this time. [3]

Previously, Dominique Stroobant (Italy) had made work in the 1980's on slow litho-films which used pinhole cameras to document the suns arcs. [4]

In 2000 the Solaris project was initiated by Decyk, Kula and Lopez who - along with; Ramon Chomon, Przemek Jesionek, Adam Ptaszynski, K.J. Baranowski, Konrad Smolenski - set about to expose numerous solargraphs all over the world for two 6 month periods. [5]

In 2002 the Poland International Photography Workshop (at Skoki) "Profile 2002" was held on the theme of Solargraphy bringing the technique to the attention of many but in particular Tarja Trygg (Finland). She went on to train others and set up an international (ongoing) project to record the sun tracks produced by solargraphy at different latitudes around the globe, since the angle of the arcs varies depending upon location. [6]

Since then the technique has gradually become more well known as reports and examples of its use become widely available through the internet and photographic magazine articles.



Solargraph example by ESO/R.Fosbury/T.Trygg/D.Rabanus [7]

3 http://www.solargraphy.com/index.php?option=com_content&task=view&id=5&Itemid=6
4 http://www.pinholeresource.com/shop/home
5 http://free.art.pl/solaris/solaris/Solaris.html
6 http://www.solargraphy.com/
7 Solargraph image available under Creative Commons attribution licence from: http://en.wikipedia.org/w/index.php?title=File:Solargraph_APEX.tif&page=1

Producing a Solargraphic Image

Making a pinhole camera body

Canister, paint (optional), duct tape/electricians tape.

Any container that can have a pinhole made in it, hold a sheet of photographic paper, be made light proof and withstand the elements as required may be used.
Darken inside of container if you want to avoid refl ections using a matt black waterproof paint.
Cut a hole in the side of the container (midway up and centered for a regular camera) slightly smaller than the pinhole plate will be. Make sure any debris is cleared from the edges as this may cast shadows on the image.

Making the pinhole plate

Aluminium drinks can, thick foil, thin brass - cut to about 20mm square.

Use a thin needle (beading needles from craft shops are ideal) to pierce the center of the material or dent the material with a tack. The dent may then be sanded until a small hole appears.

The smoother the hole the sharper the pinhole will be.

Use a pinhole calculator to work out the ideal diameter of hole for your chosen canister, although an approximation of this size will do.

Focal length of lens = (diameter of pinhole) X (diameter of pinhole) X 750

Where the Focal length of lens is the length in mm from pinhole plate to photographic paper and 750 is the constant for daylight.[8]
This gives you:

- 25mm for a film canister, ideal diameter 0.21mm.
- 65mm for a standard soft drink can, ideal diameter 0.34mm .
- 76mm for a crisp can, ideal diameter 0.37mm.

Darken any metal surface showing to avoid unwanted attention from birds and other wildlife.
Tape the plate to the camera body securely (but do not cover the pinhole!), ensure the pinhole is not obstructed by any material in the canister.

Loading the camera

Matt/satin surfaced, resin coated (RC)/fibre based, B&W photographic paper can be used.
Gloss may cause reflections and gain additional noticeable marks from the elements but will also work.
Form a plain paper or card template to fit the size of your pinhole camera.
The paper must be cut to size using the template and loaded in complete darkness or under a red safe light - dark bag or darkroom. You can make your own dark-bag by layering 6-8 black bin bags.
In the dark the side of the paper which feels shinier should face the pinhole, the duller side to the canister. Be careful not to obstruct the pinhole with the paper.
Seal the canister up using tape, make watertight if placing outdoors. Use a piece of dark tape to act as shutter over the pinhole which can be removed when the canister is in position.

Exposing the paper

Minimum time - 2 days to a week.
Maximum time - ? (examples of 3 year exposures in dry conditions)

Position to face the sun to get light trails. (an image will form with no direct sunlight too but it will not be as dramatic)
Firmly attach to a solid stationary object with tape/cable ties. A window sill or railings are ideal.
At the end of the exposure period cover the pinhole with dark tape to 'shutter' it for moving out of position.
The sun is constantly changing elevation in the sky throughout the seasons. The best times to record this are between winter equinox and the summer solstice when the earth's and sun's relative positions travel from low (Perihelion) to high (Aphelion). 2012 equinox was on the 5th of January, solstice 5th of July and then the next equinox January 3rd 2013. [9]

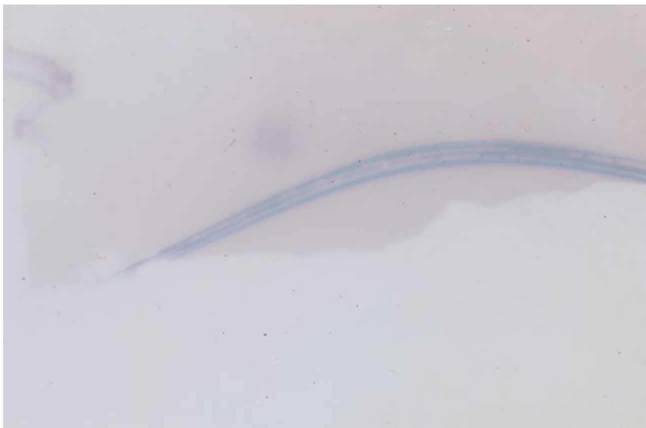
8 http://pinhole.stanford.edu/pinholemath.htm
9 http://en.wikipedia.org/wiki/Apsis

Scanning the exposed paper

Keep the paper in the camera with a tape shutter across the pinhole until you are ready to scan it.
Get the scanner ready. Make an aperture in a piece of card the same size as your exposed paper and make any adjustments to the scan area. No pre-scan should be done with the exposed paper so adjust the settings using a mock image the same size. High enough resolution to get results, low enough resolution that the scanner does not pause to buff er and cause streaks. Scan in full colour to get all the variations in the silver particle colours.
Darken the room as much as possible before opening the canister and removing the exposed paper.
If the camera has been outside and the paper is damp, either leave it in a completely dark place to dry out or gently dry with a hair dryer
Place the paper on the prepared scanner and scan once.
As soon as the scan is finished place the paper negative in a lightproof box for safe storage.
Each time the paper negative is scanned it will become darker and eventually be unusable.
(The negative may be fixed using a non bleaching fixative after initial scanning but most readily available fix solutions have bleach. Do not use developer or stop.)

Correcting the negative

Image scanned will be negative and left/right reversed.
Use an image manipulation application to invert the image and fl ip horizontally.
Additional corrections may be required to bring out contrast and brightness.




Links
2001 Solaris Project: http://free.art.pl/solaris/solaris/Solaris.html
2002 Tarja Trygg: http://www.solargraphy.com/