Subject: Lightning
Date: 30 Jun 99

Ron, I also found some interesting data under a different spelling of the word. In fact I found the opposite or earth to be positive and the sky to be negative see NASA's drawing in their on-line primer see bottom of page at:
http://thunder.msfc.nasa.gov/primer/primer2.html

However, most of the electromagnetic energy from lightning is in the very lowest part of the radio spectrum, from 0.1 to 10 kHz. The peak of the spectrum generally seems to be between 1 and 10 KHz.

Above 10KHz, the energy spectrum tails off, but has the nature of random noise - there are random peaks occurring with short durations.

Note: The following link shows a + and - of about 80 k Amp current at the bottom of the page. See
http://128.252.223.112/posts/archives/nov98/912136278.Ph.r.html

http://roselott.gsfc.nasa.gov/people/valdivia/thesis/node2.html#SECTION01110000000000000000

NASA has an interesting link that show the ground a positive and the clouds as negative. See Figure 1.2: A cloud-to-ground lightning discharge. It starts with the stepped leader propagating down. Before the stepped discharge reaches the ground, a second discharge of the opposite charge starts from the ground. The two discharges meet shorting the circuit and a return stroke is formed which propagates upward lowering the charge. This picture is taken from Uman 1987.

Note also the duration times listed.

This next link has some general technical information.
http://thunder.msfc.nasa.gov/primer/primer3.html

During fair weather, a potential difference of 200,000 to 500,000 Volts exists between the Earth's surface and the ionosphere, with a fair weather current of about 2x10-12 amperes/meter2. It is widely believed that this potential difference is due to the world-wide distribution of thunderstorms.

Present measurements indicate that an average of almost 1 ampere of current flows into the stratosphere during the active phase of a typical thunderstorm. Therefore, to maintain the fair weather global electric current flowing to the surface, one to two thousand thunderstorms must be active at any given time. While present theory suggests that thunderstorms are responsible for the ionospheric potential and atmospheric current for fair weather, the details are not fully understood.

Typically, more than 2,000 thunderstorms are active throughout the world at a given moment, producing on the order of 100 flashes per second.
http://thunder.msfc.nasa.gov/primer/primer4.html

Other interesting links:

"Science Myths"
http://www.eskimo.com/~billb/miscon/miscon.html

This type of item may be useful for our radio equipment.
Gas Discharge Lightning/Surge Protector (BNC) ($19)
http://www.grove-ent.com/LAR1B.html

Subject: Lightning surge battery charger idea to test
Sent: 27 Jun 99

Ron Darby wrote:
>
> This setup
> will almost always produce a static electrical charge, but under normal

> conditions the current available from this static charge is miniscule
> (mainly because of leakage within the capacitor). It's only when
> thunderstorms are present ... even tens of miles away ... that the static
> charge becomes great enough to "leak" through the air and produce useable
> current from the capacitor.

Based on Darrell Olson's idea about bridge rectifier, and capacitor filter - I couldn't stop thinking about how one might design a circuit to capture static electrical surges that occur during lighting storms. Ron I agree with your analysis as described above. Been thinking how to take some of the danger of component destruction and personal risk out of it and still harvest the surges to charge batteries. Still only those who fully understand and respect the dangers involved should do this testing.

If one has a lot of lightning going on, one might try the following circuit. http://home1.gte.net/ob/LIGHTNING.gif It would work best if one has lots of windmills or high posts. At the top of each, one would put up a lighting rod with a wire down to a spark gap and a good ground connection. Each lightning antenna would be wired to making the shortest path to ground through the spark gap for each high point or post. Extremely heavy gauge wire would be used for this.

The spark gap would be kept out of the rain and should be adjusted to about 1/8 inch or closer. The gap could be as simple as a heavy gauge wire wound around each end of a glass insulator. Wire ends then bent to make the proper spaced gap. The gap could be made more formally out of a half inch (or bigger) cadmium plated steel or brass bolt threaded through an angle iron bolted to plastic. The other side of the gap is a mirror image or use an angle bracket only.

A smaller wire say 16 to 12 gauge would then be run between the lightning rods and the surge limiting inductor near the battery charger as shown. The battery charging area probably should not be located inside the survival quarters or near living creatures of any kind.

The fuse is used in case the DC surge flow gets too high to avoid damaging the rectifier in a heavy duty lightning storm. I recommend making your own fuse. Put a couple of terminals in a block of wood or plastic about 6 inches or more apart. The large distance is to attempt to limit the high voltage surges that would try to jump this gap after the fuse blows and the storm is not done yet. Choose a small wire that will burn out at about half the amperage of the diodes and run this wire between the two terminals. To get this wire you can slice open a multi-strand wire and separate out the strands. Test one with an amp meter, variable resistor and a battery to see what amperage it burns out at. Use as many strands as needed to get the current you need. Warning don't try to change this fuse in the middle of a lightning storm.

Always short out the spark gap to ground, that is near the fuse, when working on this circuit. This spark gap should be adjusted slightly wider than any of the others. This is to encourage the flow directly to ground near the lightning rod.

For the inductor use one winding on an old transformer (from a TV as an example) or wind your own. This is used to limit rapid surges of current to the rectifier diodes. The gas discharge tube (neon or florescent) and 2nd inductor is optional protection and visual indication of the presence of high voltage. Find a high current and high peak inverse voltage diodes or bridge rectifier that you have available.

The capacitor is really a bit optional and is used to help level out the surges. It should not be leaky and drain the battery while waiting for the next lightning storm. Otherwise it should be as big as you can find. You can make one from a plastic (tarp or bag material) between tin foil rolled up. You may want to measure the current drain on this circuit from time to time to check whether the diodes or capacitor has been damaged. If this happens your batteries could drain down and go dead while waiting for the next storm.

If this approach works for you, battery charging voltage will not a problem. It's average current that will be low. For charging more than one battery, hook them in series. Just don't exceed the voltage of the diodes or the discharge lamp.

This circuit has not yet been tested. If anyone tests it before the PS let the rest us know if it produces enough charging current to be worth building. The problem being lightning storms are very short term and sporadic.   Just remember lighting is a spectator sport don't go working on this circuit in the presence of a storm.
