**What does an Electrodynamic tether do?**

The function of the electrodynamic tether is to harvest energy in orbit by converting the orbital energy of the satellite into electric energy. It can also be used to propel a satellite without fuel. The group wants to use the energy harvesting capabilities in a 1 U CubeSat.

**Goals include:**

* + Maximize length of tether for 1 U CubsSat as much as possible
  + Deploy the tether effectively
  + Develop the most efficient electrodynamic tether possible at this scale
  + Harvest as much energy as having solar panels cover all sides of the CubeSat

**Theory**

An electrodynamic tether is in its most basic form, a long conducting wire extended from a spacecraft. The gravity gradient field pulls the tether and orients the tether towards earth at all times. As the tether orbits around the Earth, it moves perpendicular to the Earth's magnetic field lines at an orbital velocity. The motion of the conductor across the magnetic field induces a voltage along the length of the tether. With this, a Lorentz force is produced on the wire, causing an acceleration.

Usually, a uniform magnetic field acting on a loop of wire yields a net force of zero, since the force on one side of the loop is flowing in the opposite direction of the other side. Electrodynamic tether circuits cannot be completed by simply using another wire, since another tether will develop a similar voltage. This is solved because in the Earth's magnetosphere is there are highly electrically conductive plasmas which are kept partially ionized by solar radiation or other radiant energy. It is known that a positively charged bare conductor can readily remove free electrons out of the plasma. To complete the electrical circuit, a large area of uninsulated conductor is needed at the upper end of the tether, thereby permitting current to flow through the tether. Aided by the hollow cathode emitter, which is vital: without it, the wire’s charge distribution would quickly reach equilibrium and no current would flow.

**Tether Material**

Decisions on the material used for the tether are being investigated. High conductivity is wanted in the wire, but we need a lighter weight tether to maximize the length of the material allowed in the parameters of the CubeSat. The tensile strength of the material is also considered, especially if the tether itself will only be the wire. This will depend on the deployment mechanism used. Right now different aluminums and coppers are being evaluated.

**Inside Deployment Mechanisms**

The design that is being prototyped is for storing the tether inside the CubeSat and then feeding it outside the CubeSat. The current method is using a type of spring, or crossbow design. The tether is wound up to be released, and the mass at the end is lined up in front of a compressed spring. The cap to the mechanism Is held in place by fishing line which can be cut by heating up nichrome wire using electricity stored up by the CubeSat’s solar panels. When the fishing line is cute, the force of the compressed spring will push the mass out of the CubSat and start unwinding the tether for deployment.

**Outside Deployment Mechanisms**

The other design that has been prototyped is unique because the tether would be stored outside of the CubeSat. In this design the tether is split into structural component and an electrical component. The structural component of the tether is made of measuring tape, with whatever electrical wire component that is chosen wrapped around it. The tether would be wrapped around 4 sides of the CubeSat, taking the surface area of the measuring tape away from the solar panels on the CubeSat. The measuring is held in place by fishing wire that is cut by heating up nichrome when the mechanism is to be deployed. The box of the prototype is 3D printed.

**Goals for Spring/Summer 2016**

* Decide on Deployment Mechanism
* Improve Deployment Mechanism
* Design the circuitry for the tether
* Prototype circuitry

**Long Term Goals (2016 – 2017)**

* Improve design for space flight
* Integrate with the Dev kit
* Gain approval by the CSLI