**1. Define a Problem**

* Details of the problem may develop/change over the course of your Capstone.
* Producing interband cascade devices (photo detectors and Lasers) that work at room temperature.

**2. Brainstorm**

* We know that something is inconsistently going wrong with the processing of the device. To understand this better we would like to look at the process in more depth. This will give us a better idea of which process to target.
* To give us the better look into the control process we are setting up the
* Currently we are thinking that stress is being introduced into the device.

**3. Research**

* We want to get more information about the result of each processing step being done. To know it they are good we have to have a model of what we expect at each step.
* These models can be of
  + Material properties like stress (flexing of layers), strain, ect.
    - These methods are generally destructive
  + Electrical properties like resistance, IV curves, ect.
  + Topographical/material quality like holes, lumpiness, ect.

**4. Identify Criteria and Specify Constraints**

* We want to test the samples during processing. To do this during the processing we **cannot use destructive testing** or else we would have to fabricate new devices.
* Not using destructive testing limits us to pictures and electrical testing.
* Electrical testing has the problem of needing to have a good contact which usually means that the device has to be permanently altered.
* Electron microscopy can leave films of carbon and cause damage to the device

**5. Explore Possibilities**

* To overcome the “good contact” problem we will use probes tipped with gold wire to limit damage on the gold surface of the devices.
* We are currently taking measurements with digital multimeters
* It could be helpful to move to having IV curves because they give resistance more accurately and will give more data.
* We can take optical and Scanning Electron Microscopy pictures

**6. Select an Approach**

* We are testing using probes and multimeters because it is quick and easy, but we can revise the system when this method proves to be fruitful

**7. Develop a Design Proposal**

* Explore the idea in greater detail (sometimes with annotated sketches).
* Make critical decisions such as: material types, manufacturing methods, or software .
* Generate through computer models detailed sketches to further refine the idea.

**8. Make a Model or Prototype**

* Make models to help communicate the idea, and study aspects such as shape, form, fit, or texture.
* Construct a prototype from the working drawings, so the solution can be tested.

**9. Test/Evaluate Design**

* Design experiments and test the prototype in controlled and working environments.
* Gather performance data; analyze and check results against established criteria.
* Conduct a formal critique to flesh out areas of concerns, identify shortcomings, and establish any need for redesign work.

**10. Refine the Design**

* Make design changes; modify or rebuild the prototype.
* Make refinements until accuracy and repeatability of the prototype’s performance results are consistent.
* Update documentation to reflect changes.
* Receive user’s critique to provide outside perspective to help determine if established criteria have been met.

**11. Create or Make Solution**

* Determine custom/mass production.
* Consider packaging.

**12. Communicate Processes and Results**

* Communicate the final solution through media such as PowerPoint, poster session, technical report.
* What remaining work needs to be done.