**1. Define a Problem**

* Discuss possible **problems** to address with your Advisor.
* What is the background of these **problems**?
* What is the motivation for their **solution**?
* Details of the problem may develop/change over the course of your Capstone.

**2. Brainstorm**

* With your Advisor brainstorm possible smaller “**starter problems**” and steps toward the full **solution**.
* Develop preliminary ideas.
* Present ideas in an open forum.
* Record all ideas.

**3. Research**

* Find good resources (text books, tutorials through papers) to introduce you to the background of the **problem**/ subject.
* Find resources directly associated with the **problem** itself.
* Are there solutions out there?
* Research solutions that may already exist (products available, patents etc.)
* Identify shortcomings and reasons why they aren’t appropriate to a given situation.
* Keep good notes/references, compile ideas and report findings to the team/Advisor.

**4. Identify Criteria and Specify Constraints**

* Identify what the **solution** should do and the degree to which the **solution** will be pursued.
* Identify constraints: *e.g.*, time/ cost/ size/ weight/ safety/ computation time *etc.*
* Make a brief summary.

**5. Explore Possibilities**

* Consider further development of brainstorming ideas with constraints and tradeoffs.
* Explore alternative ideas based on further knowledge.

**6. Select an Approach**

* Review brainstormed information and answer any lingering questions.
* Narrow ideas down using a decision matrix.
* Decide on final idea, sometimes through consensus.

**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.