Rapid Learning Cycles (RLC's) for Engineering Design

(RE: Katherine Radeka *The Shortest Distance Between You and Your new Product*)

Overall process:

- Learn before design
- Maintain regular cadence (steady pace)
- Use scientific thinking to close knowledge gaps
- Capture knowledge
- Delay decisions until last reasonable moment

Define the problem (create problem statement, create criteria table)

Problem statement: clearly articulates the need or problem. It should NOT suggest a solution.

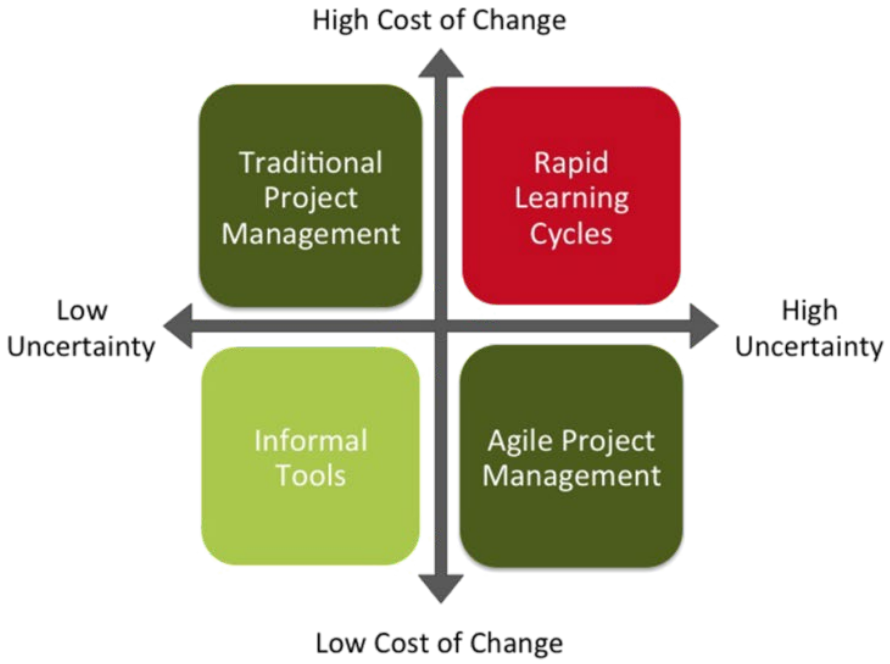
Criteria – as a team, define details to describe a successful finished product (again, do NOT suggest solutions). The more specific the better. Vague criteria are fuzzy targets. As much as possible, include quantities. The criteria may be revised as the project progresses.

Create a criterial table with more important criteria at the top, least important at the bottom. Example:

Table 1 – lawn mower design criteria.

#	Criteria	Priority	Description
1	Safe to operate	Essential	Must meet all governing regulations and standards
2	Economical	High	Maximum unit production cost of $100, maximum development cost $100K
3	Portable	High	Weigh less than 40 pounds and be easily lifted
4	Easy to start and operate	High	Require no more than 20 pounds force to start (if using a manual starter system), should require no more than 10 pounds to push on flat level ground covered with 4 inch tall grass
5	Easily serviced	Medium	Routine service should possible with standard tools (screwdrivers, wrenches and hammers) and should be able to be performed by untrained users in 15 minutes

When to use Rapid Learning Cycles in design:



Key Decisions (KD's) - Key decisions are decisions that have high impact but also high uncertainty. Before a key decision is made, knowledge must be gained. KD's are well-defined questions with choices. Examples:

- What materials WILL we use?
- Which supplier WILL we choose?
- What sort of engine WILL we select?

Engineering is the process of going from high ignorance, to lower ignorance

Knowledge Gaps (KG's) – knowledge you need to make a good Key Decision

Let's Practice:

Key Decision format (use green sticky notes, 1 KD per sticky note**)**.

- Write a brief description large enough to see from a distance. Use black sharpie.
- Assign KD # and owner later. Each KD needs 1 and only 1 owner.

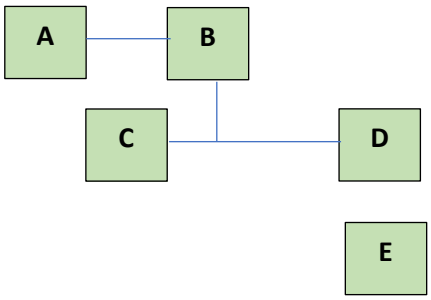
As a team, identify decisions for the project, then identify which decisions are KD's (high impact and high uncertainty). You may need to revisit this later, but do the best you can at the beginning.

KD #

Brief description of 1 KD

Owner's name

As a team, identify decision flow – which decisions depend upon other decisions, which decisions should be made early, and which ones later. All decisions should be postponed until the LAST RESPONSIBLE MOMENT. Place the sticky notes on a wall or similar surface.



Identify Knowledge Gaps (KG's) for each KD. Each KD should have one or more KG's.

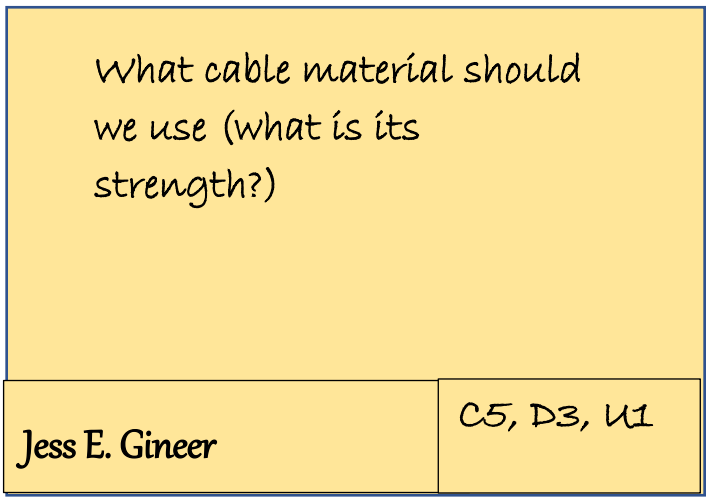
- What is keeping us from making the decision today/now?
- What do we need to learn before making a decision?

Individuals use yellow sticky notes to write very concise questions they would like answered.

Team discusses all the KG's and identifies and rates (1 to 5 scale) the following for each KG:

C: Criticality (how important is the KG)	1 = not important	5 = essential
D: Duration (how long will it take to answer the KG)	1 = short (1 day)	5 = very long (5 weeks)
U: Uncertainty (how likely is it you will not get an answer)	1 = low risk	5 = high risk

Team identifies the "owner" of the KG (which individual will be responsible for finding an answer). Write these on a yellow sticky note:



The team should set priorities – who will work which KG's first:

- The more critical the KG, the higher its priority (be sure to work these)
- Longer duration – be sure they are completed before needed
- The more uncertain, the greater the need for a "work around" (what if you can't find an answer in time?)
- Not all Knowledge Gaps will necessarily be closed!

ICA: Teams of about 3 or 4 students. Design a "mousetrap powered vehicle"

- Task 1 – understand the problem
- Task 2 – create a problem statement
- Task 3 – define criteria
- Task 4 – identify Key Decisions (KD) – make the green sticky notes.
- Task 5 – create a flow diagram of KD's – arrange KD's on wall
- Task 6 – identify Knowledge Gaps (KG's) for the Key Decisions
- Task 7 – complete the yellow sticky-notes, place them with the KG sticky notes.