**Assignment A3 – System Architecture and Concept Generation**

Summary

In this third assignment you will generate ideas and concepts that have the potential to satisfy the requirements of the 2016 Cansat competition that you discussed and analyzed in assignment A2. In order to generate these concepts we ask you to apply at least one structured and one unstructured creativity technique. We also ask you to document at least one concept using OPM.

This assignment is worth 1/8 (12.5%) of your final grade. The final deliverable must be uploaded as a single PDF file with the name: *A3_Team#_2015.pdf*.

In addition to your team number and name, all team members who contributed must be clearly identified by name and email address on the first page of your submission.

1. Paper Critiques

Read the following two papers by Prof. Edward Crawley et al. and by Prof. Maria Yang on system architecture, and the relationship between different creativity techniques and design outcomes and provide a 1-2page written scholarly critique of each paper (what is the paper about? What do you agree with? What do you disagree with? What does it mean for your team?). The papers have been posted online.

Edward Crawley, Olivier de Weck, Steven Eppinger, Christopher Magee, Joel Moses, Warren Seering, Joel Schindall, David Wallace, Daniel Whitney, "The Influence of Architecture in Engineering Systems", Monograph, 1st Engineering Systems Symposium, Cambridge, Massachusetts, March 29-31, 2004

Yang, Maria C. "Observations on concept generation and sketching in engineering design." *Research in Engineering Design* 20.1 (2009): 1-11.

2. Concept Generation

Consider the concept generation and creativity techniques discussed in session 4. Select one of the unstructured techniques (e.g. brainstorming, bio-inspired design…) and one of

the structured processes (e.g. morphological matrix, architecture enumeration, mind mapping) to generate potential concepts. Show the results from both processes in your write-up and compare the results. Which of the processes did your team think were more productive (# of concepts generated per unit time)? Which of the techniques was more effective (# of high quality concepts)?

3. OPM Diagram and Sketch

For one of the concepts generated in step 1 create an Object-Process-Diagram (OPD) either by hand, using a graphics program, or OPCAT. The emphasis of the OPD is to show the functions (ovals) and how they map to elements of form (rectangles). If you think it is important show which states are affected by the processes. The key is to show the function-form mapping of one of your concepts at a high level. If needed you can go to two levels of decomposition (but probably not more than two levels). Show any obvious "chunks" or modules in your concept, i.e. portions of your concept that are tightly coupled within.

In addition to the OPD, create a narrative text that describes the essence of your concept and provide a visual sketch (does not have to be CAD at this point, there is research showing that going to CAD too early limits creativity) depicting your concept.

Note that the concept you show in this step does not have to be "down-selected" from the larger set you produced in step 1. Concept selection will happen in assignment 4. Here we simply ask you to pick one possible concept that has the potential to satisfy the technical requirements.

4. Derived Technical Requirements

Demonstrate how the concept you described in step 3 satisfies the CONOPS you elaborated in Assignment A1. Which part of the CONOPS appears to be straightforward and which ones do you deem to be more challenging?

Derive any additional technical requirements from the concept you defined that you were not able to define yet in assignment A2 (before concept generation). These new more refined technical requirements are no longer solution "neutral" but depend on your selected of concept. Submit a new requirements baseline by adding the derived requirements to the original requirements you submitted in assignment A2.

Grading Rubric and Time Commitment

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| 1. Paper Critique | max 20 Points |
| 2. Concept Generation | max 40 Points |
| 3. OPM Diagram and Sketch | max 30 Points |
| 4. Derived Technical Requirements | max 10 Points |
| Total | max 100 Points |

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