	STEM Committee **Michigan Crossroads Council**	**Name:**	
	Supernova Activity Topic: Engineering **Deconstruct and Analyze: Mechanical Designs**	**Troop:**	**Date:**

Supernova Activity Topic: Engineering

Have you ever studied how your bicycle works? To learn how a bicycle is put together (or engineered), here is a project for disassembling one. Or what about making a high-performance paper glider? Or having a contest to see who can drop a raw egg without breaking it? Choose any one of these activities to learn more about engineering.

Deconstruct and Analyze: Mechanical Designs

This activity can be done individually or in a small group. Your task is to take apart a bicycle (or other suitably complex mechanical device; see the note below), analyze the components, and describe how the components work (both separately and together).

Part 1: Preplanning and Set-Up

1. Do the following:
   A. With your mentor's assistance, choose an unwanted older bicycle—or any other complex mechanical device—perhaps not completely in working order, that is a bit beyond what you feel comfortable dismantling.

      _____

      _____

   B. Find a location for the project where you can take things apart, leave the pieces undisturbed, and come back another time.

      _____

      _____

   C. Determine and gather the necessary tools. You are encouraged to find resources to help you with the deconstruction, such as written instructions or a repair specialist willing to volunteer his/her time. (The specialist cannot touch the object or the parts, or handle the tools during dismantling. You and any fellow youth must do all of the dismantling.)

      _____

      _____

      _____

Part 2: Deconstruction, Analysis, and Report

This next phase involves deconstructing the device. Take pictures as you work, and make notes of what is happening in each picture.

1. Determine the following:
   A. The major components of the bicycle

      _____

      _____

   B. What parts make up each component

      _____

      _____

C. How the components work together

_____

_____

D. The mechanical or electronic advantages that a minimum of three parts or circuits convey

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_____

It is not crucial for the object you deconstruct to be a bicycle. Any mechanical device, machine, or tool will do, as long as it is suitably complex for your abilities and knowledge and is approved by your mentor. Examples include but are not limited to manual typewriters, old clocks, old sewing machines, and so on.
If you wish to deconstruct something that is electronic in nature (rather than just mechanical), then you will need to learn about additional safety protocols that must be observed while deconstructing electronics. Your mentor may suggest and help to secure the help of a qualified electronics expert for those projects. You must demonstrate to your mentor that you know and understand these additional safety protocols prior to beginning your deconstruction.
Whatever you choose to deconstruct, you must adapt the questions above to suit the object you are deconstructing and address those questions in your report.

2. Discuss the following with your mentor:
   A. What might cause a failure in one of the components

   _____

   _____

   B. The kinds of failures that can be fixed if you are using the device away from home (for example, if you are out mountain biking)

   _____

   _____

   C. The basic elements of keeping the device well maintained

   _____

   _____

   D. Considering the intended owner/user and uses of this device, discuss improvements to the design that could be made.

   _____

   _____

3. Create a report that communicates your understanding of the experience and addresses the following points.
   A. Document the deconstruction process, your analysis of the components, and how they work together

   _____

   B. Document your analysis of failure possibilities plus maintenance requirements, and what these suggest about design improvements

   _____

Resources

Bryan Bergeron. *Teardowns: Learn How Electronics Work by Taking Them Apart.* McGraw-Hill/TAB Electronics, 2010.

Naval Education and Training Program. *Basic Machines and How They Work.* Dover Publications, 1997.