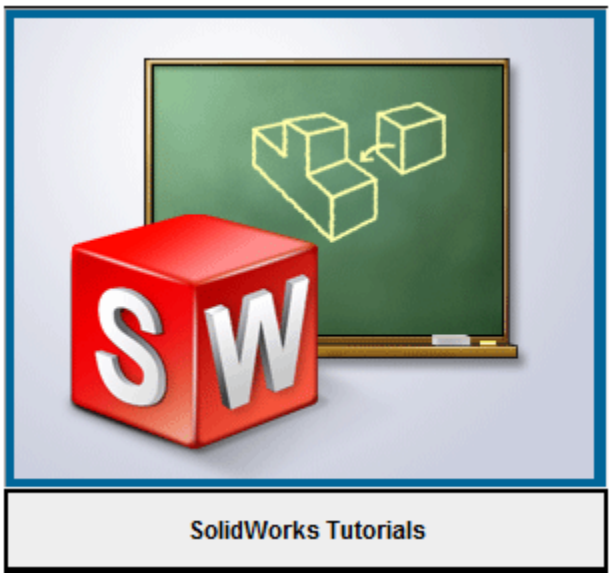
SolidWorks: Project Based Learning

SolidWorks



Before beginning the project, students must be able to complete the following tasks in SolidWorks:

Create parts

Create assemblies

Create drawings

Apply ANSI standards

Revision control

- Introduction to SolidWorks
- AutoCAD and SolidWorks
- Lesson 1: Parts
- Lesson 2: Assemblies
- Lesson 3: Drawings

While doing the project, students will need to learn to:

Create animations

Create renderings

Create documentation package

Other “Fill in the Blank” skills

- Advanced Drawings
- Animation
- SolidWorks eDrawings

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PROJECT BASE LEARNING - EXERCISE 1

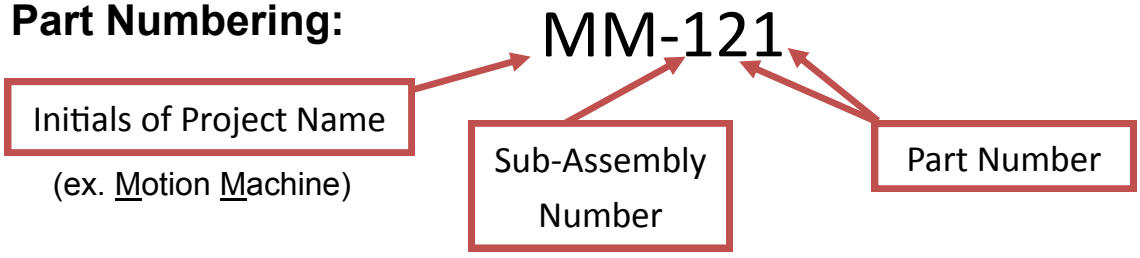
PROJECT SELECTION

Initially projects will be chosen from the book of “Wooden Gadgets”. Later projects will be assigned to the student or team. The beginning projects should be simple and “makeable” (3D printer, techno or HAAS mill). A sample project will be used in this tutorial to illustrate the principles of PBL.

PROJECT PROPOSAL

Before beginning work on the project in SolidWorks, students are required to present their project to the instructor. The proposal should include copies of project from “Gadget Book”, a basic layout of their cover page, rough sketches of parts, and a sketch of the Project Design Tree with a completed numbering system (see page 4 for examples). Scanned copies of the Gadget Books are located here: K:\Teachers\(Teacher Name)\COMMON FOLDER\ENGINEERING III\SW Core Project\Gadget Books

1. **Copies:** Scanned copies of the pages used in the “Gadget Books”
2. **Cover Page - should include:**
   - Name of Project
   - Rough 3D Sketch of the Complete Assembly
   - Student Name
   - School, ROP, and SolidWorks logos
3. **Sketches:** Preliminary sketches of each part in the project
4. **Project Design Tree:** Chart showing full assembly and any subassemblies and their parts with part numbers
5. **Part Numbering:**

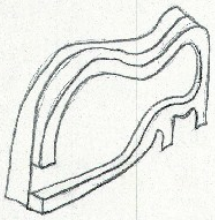


CHS

CHS Symbol

ROP

Excentric Squirrel FAN



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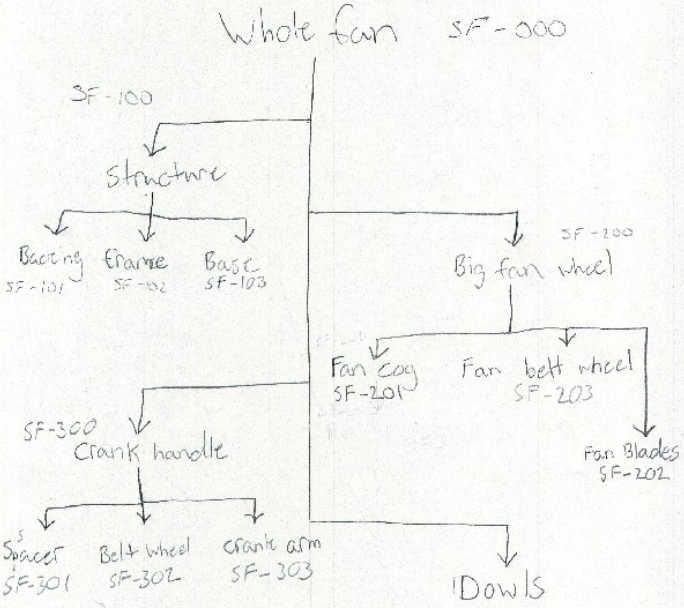
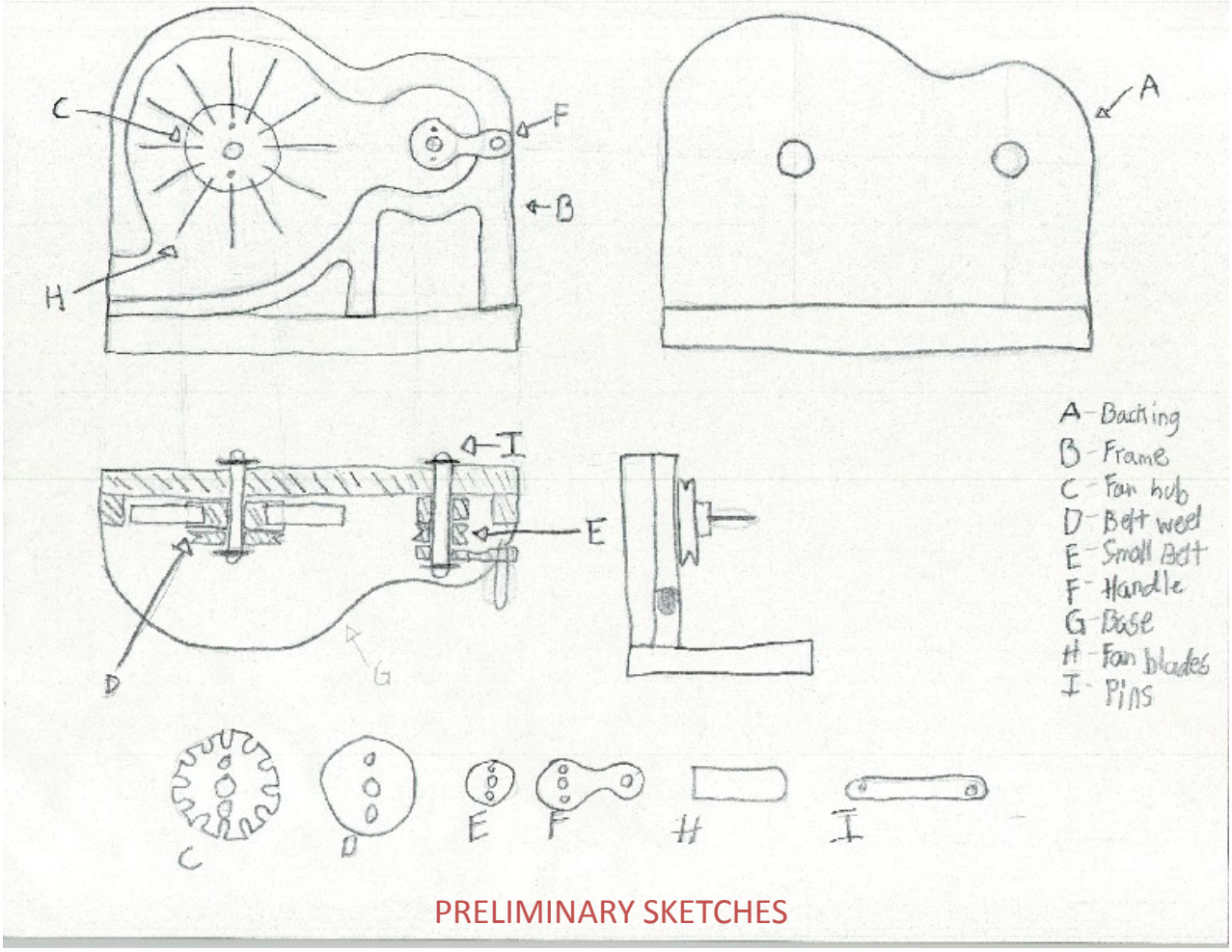
BRANDON GROSBERG

COVER PAGE



PROJECT DESIGN TREE



PRELIMINARY SKETCHES

DURING PROJECT

During the project students will be continually keeping record of their work on the project. Students need to keep track of:

Procedure: Written record of what was completed each day of the project.

1. Date and task
2. Description

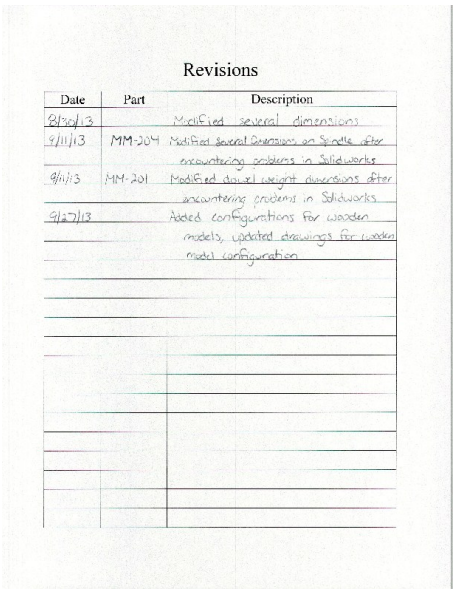
Revisions: Written record of any changes made to the project

1. Date and part that was revised
2. Description

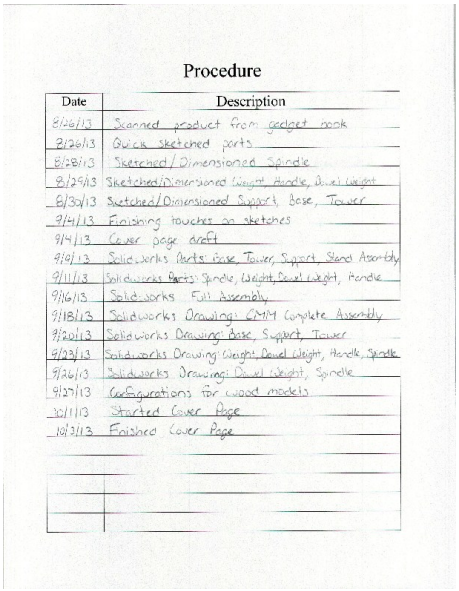
Challenges: Written record of conflicts which arose during the project

To keep the Procedure, Revisions, & Challenges neat a template can be printed off from here :

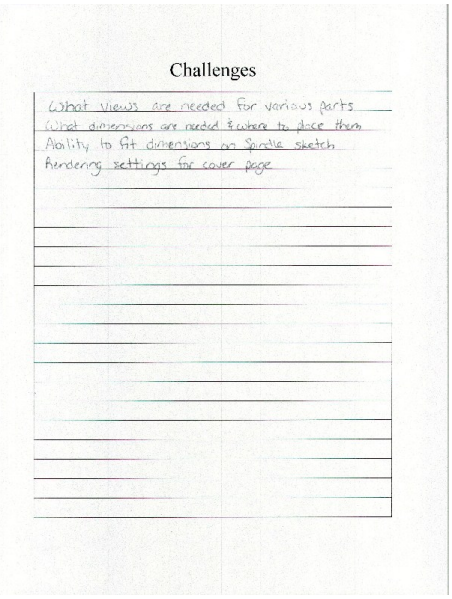
K:\Teachers\(TeacherName)\COMMON FOLDER\ENGINEERING III\SW Core Project


Revisions

Date	Part	Description
8/30/13		Modified several dimensions
9/11/13	MM-204	Modified several dimensions on Spindle after encountering problems in Solidworks
9/11/13	MM-201	Modified dowel weight dimensions after encountering problems in Solidworks
9/27/13		Added configurations for wooden models, updated drawings for wooden model configuration


Procedure

Date	Description
8/26/13	Scanned product from gadget nook
8/26/13	Quick sketched parts
8/28/13	Sketched/Dimensioned Spindle
8/29/13	Sketched/Dimensioned Weight, Handle, Dowel Weight
8/30/13	Sketched/Dimensioned Support, Base, Tower
9/4/13	Finishing touches on sketches
9/4/13	Cover page draft
9/9/13	Solidworks Parts: Base, Tower, Support, Stand Assembly
9/11/13	Solidworks Parts: Spindle, Weight, Dowel Weight, Handle
9/16/13	Solidworks Full Assembly
9/18/13	Solidworks Drawing: CMM Complete Assembly
9/20/13	Solidworks Drawing: Base, Support, Tower
9/23/13	Solidworks Drawing: Weight, Dowel Weight, Handle, Spindle
9/26/13	Solidworks Drawing: Dowel Weight, Spindle
9/27/13	Configurations for wood models
10/1/13	Started Cover Page
10/3/13	Finished Cover Page


Challenges

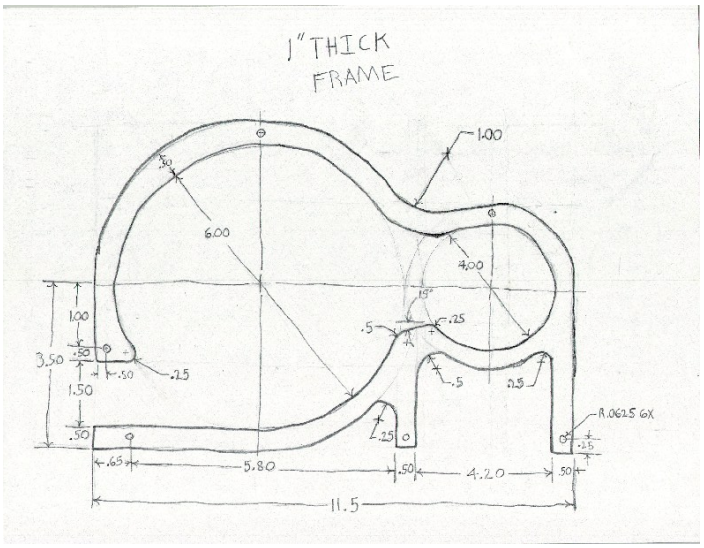
What views are needed for various parts
What dimensions are needed & where to place them
Ability to fit dimensions on Spindle sketch
Rendering settings for cover page

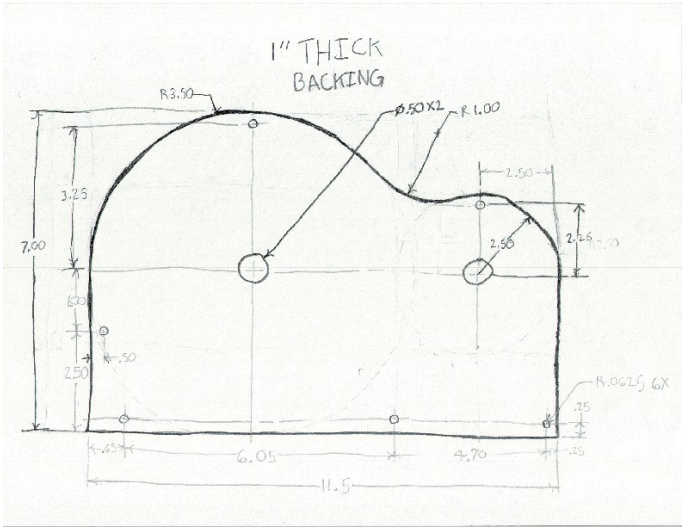
PROJECT BASE LEARNING - EXERCISE 2

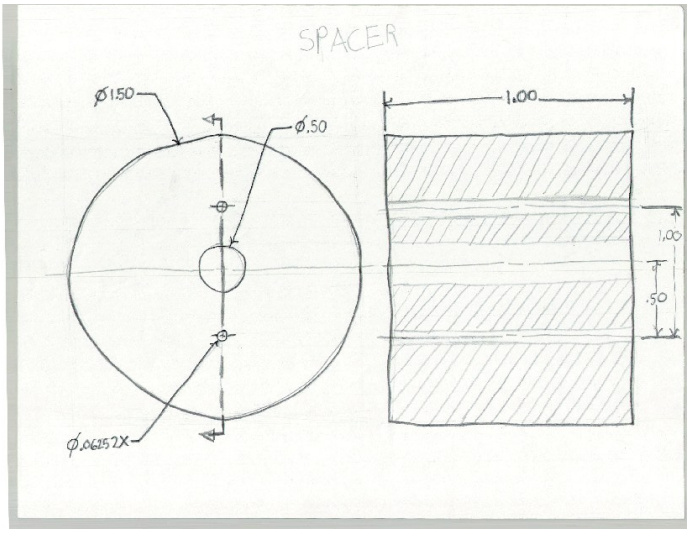
SKETCHES

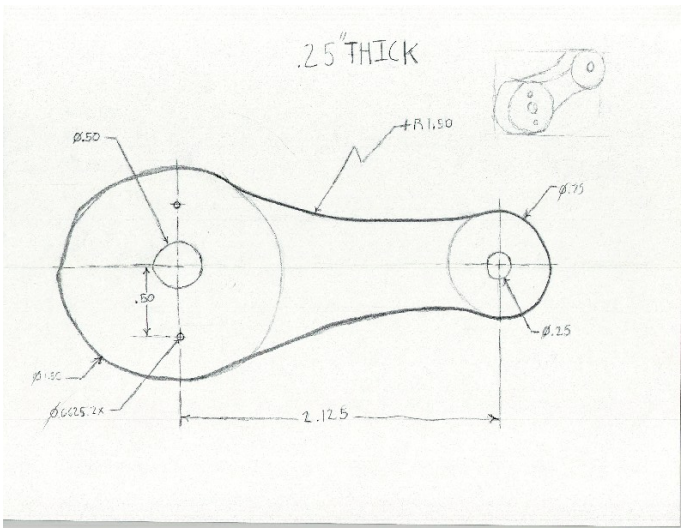
After receiving project approval from instructor, students will begin making detailed sketches of each part in their project. These sketches will then be presented to the instructor for approval. Sketches should:

- Be neat and fully dimensioned
- Include necessary views
- Include one 3D view of one of the parts / assemblies
- Use textbook / Engineering 1 drawings as references









PROJECT BASE LEARNING - EXERCISE 3

SOLIDWORKS MODELS

After instructor approval for Part 2, students begin 3D models of their project in SolidWorks. When making parts and assemblies:

1. Limit the number of features in each part and ensure there are no broken mates
2. Create sub-assemblies if the project has many parts
3. Final assembly should be made up of sub-assemblies, not individual parts (fasteners can be added individually)
4. Explode the main assembly and insert exploded lines for use in the assembly drawing and animation (Exploded lines tutorial located:
5. Save each part / assembly with it's part number and a short description of the part (ex. MM-199 Hammer Belt Adjuster)

Model Building:

1. **3D Printer Parts**: To be prototyped with the 3D Printer - dowel pins should be made attached to part bodies where necessary
2. **Stock Parts**: such as wooden dowel rods and metal fasteners should be acquired separately
3. **CNC Mill Parts**: to be produced with MasterCAM and the CNC mill where necessary

PROJECT BASE LEARNING - EXERCISE 4

SOLIDWORKS DRAWINGS

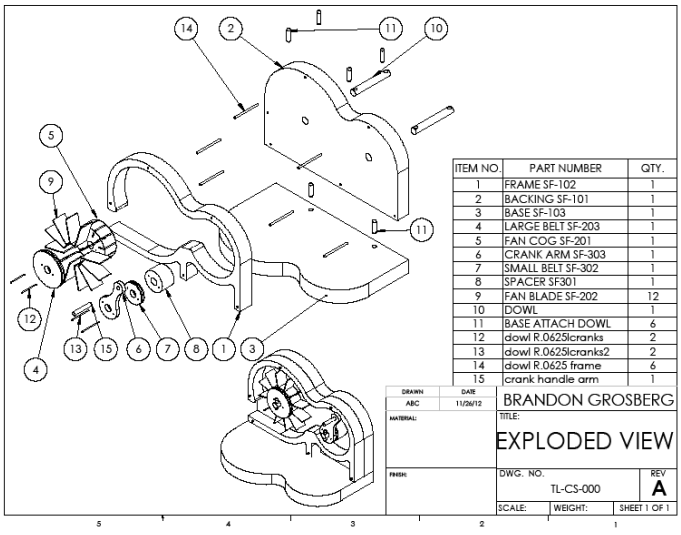
Upon completion of the models in SolidWorks students must make technical drawings of each part in their projects on the provided template. To obtain the correct drawing template students should complete the DRAWING TEMPLATE SET-UP tutorial located in:

K:\Teachers\(*Teacher Name*)\COMMON FOLDER\ENGINEERING III\SW Tutorials.

After setting up the drawing template, complete drawings as follows:

1. **Necessary views**: include all views needed to understand and manufacture the part including any section views, assembly views, exploded views, etc.
2. **Dimensions**: include all needed dimensions, in the proper location according to ANSI standards (reference textbook if necessary)
3. **Notes**: include all necessary notes needed to manufacture the part (ex. Material thickness, wood type, pipe or sheet metal gauging)
4. **Table**: A full assembly parts table is needed. A tutorial for inserting a default table is located here:

K:\Teachers\(Teacher Name)\COMMON FOLDER\ENGINEERING III\SW Tutorials



ITEM NO.	PART NUMBER	QTY.
1	FRAME SF-102	1
2	BACKING SF-101	1
3	BASE SF-103	1
4	LARGE BELT SF-203	1
5	FAN COG SF-201	1
6	CRANK ARM SF-303	1
7	SMALL BELT SF-302	1
8	SPACER SF301	1
9	FAN BLADE SF-202	12
10	DOWL	1
11	BASE ATTACH DOWL	6
12	dowl R.0625lcranks	2
13	dowl R.0625lcranks2	2
14	dowl R.0625 frame	6
15	crank handle arm	1

DRAWN	DATE
ABC	11/26/12

MATERIAL:

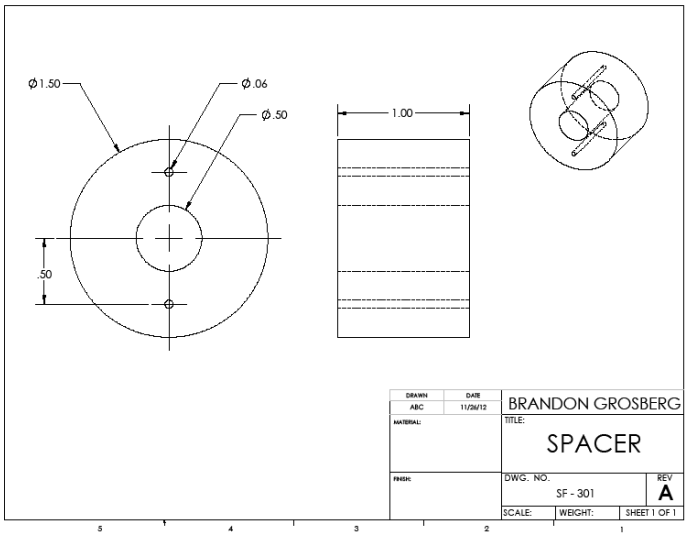
FINISH:

BRANDON GROSBERG

TITLE: EXPLODED VIEW

DWG. NO. TL-CS-000 REV A

SCALE: WEIGHT: SHEET 1 OF 1



DRAWN	DATE
ABC	11/26/12

MATERIAL:

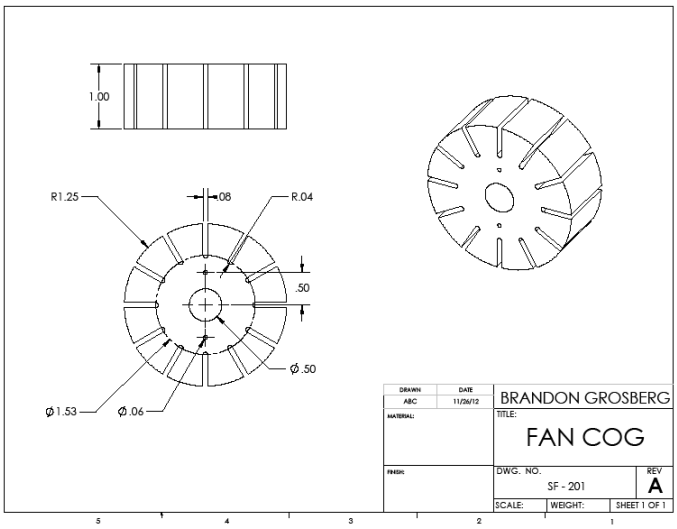
FINISH:

BRANDON GROSBERG

TITLE: SPACER

DWG. NO. SF - 301 REV A

SCALE: WEIGHT: SHEET 1 OF 1



DRAWN	DATE
ABC	11/26/12

MATERIAL:

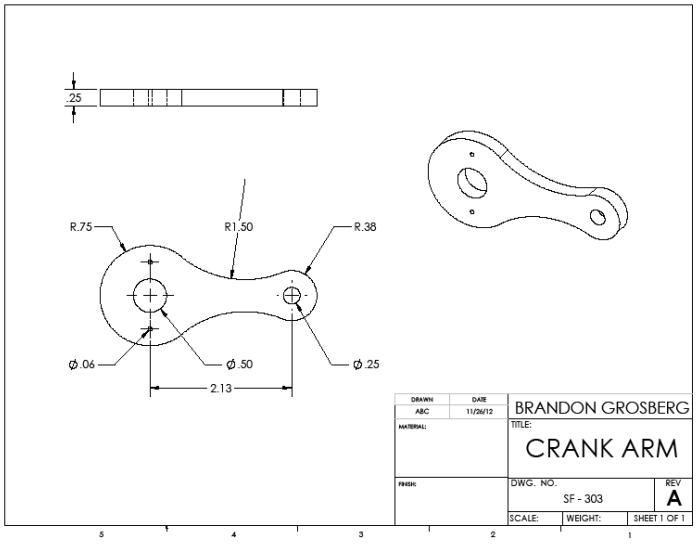
FINISH:

BRANDON GROSBERG

TITLE: FAN COG

DWG. NO. SF - 201 REV A

SCALE: WEIGHT: SHEET 1 OF 1



DRAWN	DATE
ABC	11/26/12

MATERIAL:

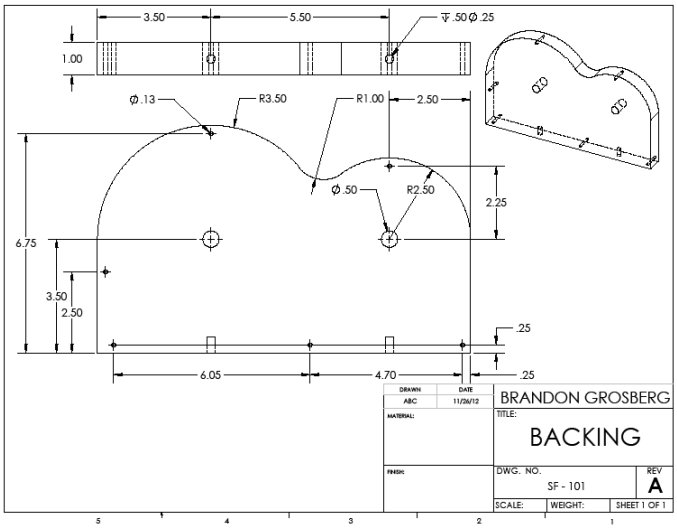
FINISH:

BRANDON GROSBERG

TITLE: CRANK ARM

DWG. NO. SF - 303 REV A

SCALE: WEIGHT: SHEET 1 OF 1



DRAWN	DATE
ABC	11/26/12

MATERIAL:

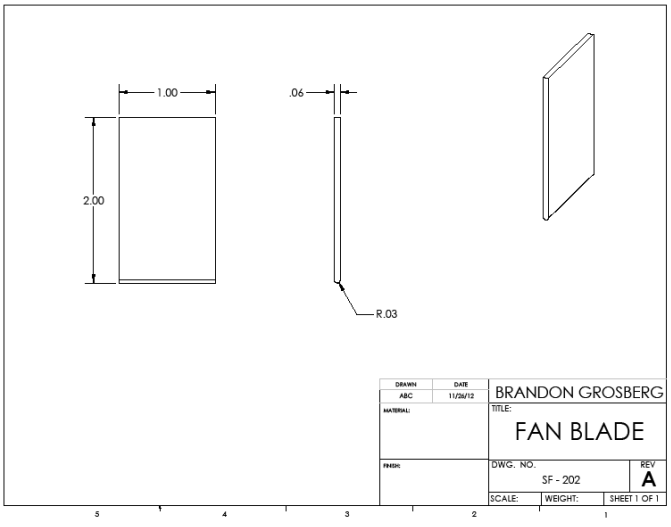
FINISH:

BRANDON GROSBERG

TITLE: BACKING

DWG. NO. SF - 101 REV A

SCALE: WEIGHT: SHEET 1 OF 1



DRAWN	DATE
ABC	11/26/12

MATERIAL:

FINISH:

BRANDON GROSBERG

TITLE: FAN BLADE

DWG. NO. SF - 202 REV A

SCALE: WEIGHT: SHEET 1 OF 1

PROJECT BASE LEARNING - EXERCISE 5

RENDERINGS

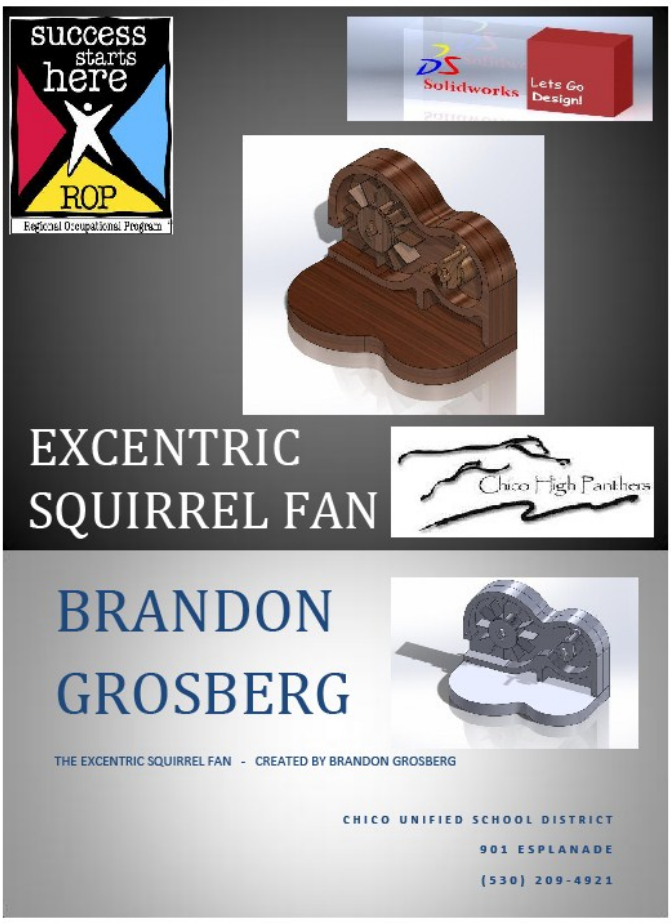
Students need renderings of their complete assembly and each part in their assembly, which will be used on the Cover Page and Project Design Tree. Students should complete the RENDERING TUTORIAL located in:

K:\Teachers\(Teacher Name)\COMMON FOLDER\ENGINEERING III\SW Tutorials.

COVER PAGE

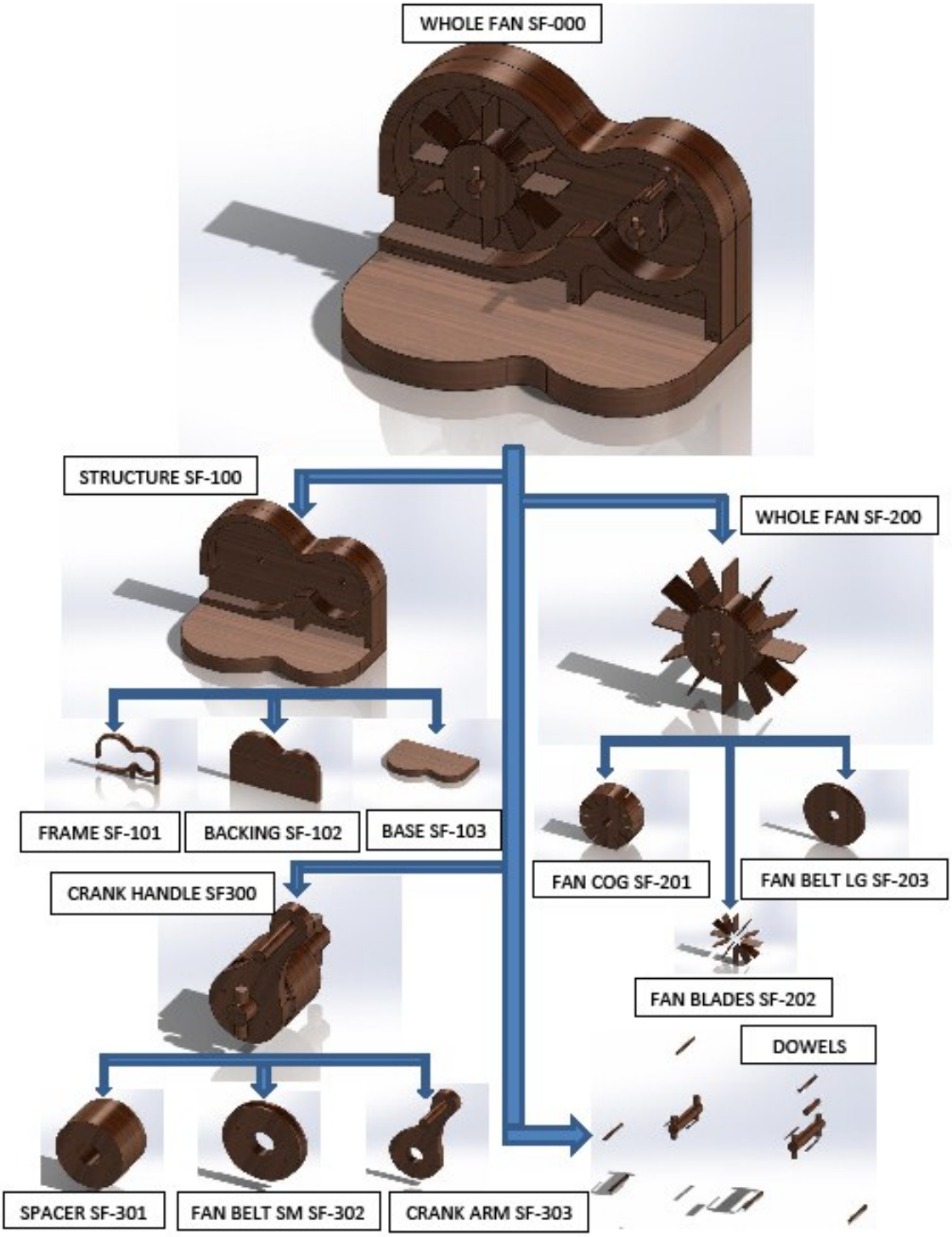
Final cover page should be clean and organized with a realistic rendering of the project. The cover page is most easily made in Publisher. Should include:

1. Name of Project
2. 3D rendering of project
3. Student Name
4. School, ROP, and SolidWorks logos



Project Design Tree

Flowchart should include renderings of assemblies and sub-assemblies and parts connected with arrows. Each part and assembly should be labeled and organized. Include part numbers in design tree. The flowchart is most easily made in Publisher.



PROJECT BASE LEARNING - EXERCISE 6

ANIMATIONS

Students need to also make a animation of their project. Students should complete the ANIMATION TUTORIAL located in:

K:\Teachers\(Teacher Name)\COMMON FOLDER\ENGINEERING III\SW Tutorials.

Animations should include:

1. Project in actual realistic motion
2. Part by Part animated explode and collapse of entire project
3. Saved AVI file of animation

PROJECT BASE LEARNING - EXERCISE 7

3D PRINTER (CNC Mill where applicable)

Once students have completed their project through Exercise 6, they may print their project using the 3D printer. Students need to make sure to take pictures of themselves using the 3D printer for use on their websites and in their portfolio. Follow these steps for using the 3D printer:

Step 1: Open part in “SolidWorks”

Step 2: Go to file, save as, save as type “STL”

Step 3: Open program “CatalystEX 4.4”

Step 4: Go to file “open STL” & find the part

Step 5: You can change the part features on the “General” page

Step 6: Click “Add to Pack”

Step 7: Go to the “Pack” page and place the part on the pallet

Step 8: Turn the 3D Printer on by flipping the switch on the side

Step 9: Place pallet in printer

Step 10: Press “Wait for Part”

Step 11: Select the printer you want in “CatalystEX 4.4” and press print

PROJECT BASE LEARNING - EXERCISE 8

PROJECT ASSEMBLY

After their projects have finished printing, students will assemble their projects using glue, and then paint them and ensure they function as they should. During this process students should also be taking pictures for use on their websites and in their portfolios.

PROJECT COMPLETION

Project Portfolio:

Cover Page (printed final draft with rendering of project)

Hand Work:

1. Cover Page Sketched Draft
2. Sketched Project Design Tree
3. Handwritten Procedure, Challenges, & Revisions
4. Project Proposal Sketches
5. Detailed Sketches

Computer Work:

1. Transition Page (Rendering of Project with description)
2. Printed Project Design Tree (rendered parts)
3. Printed list of all parts and part numbers
4. Printed Procedure, Challenges, & Revisions
5. SolidWorks Technical Drawings
6. Scanned pages from Gadget book
7. AVI file of project animation
8. Assembled Prototype of Project

TABLE OF CONTENTS CHECKLIST

Project Portfolio:

- FRONT COVER PAGE (FINAL)
- FRONT COVER PAGE (HAND DRAWN)
- GADGET BOOK PAGES
- LAYOUT SKETCHES
- TREE DIAGRAM (HAND DRAWN)
- PROCEDURE
- REVISIONS
- CHALLENGES
- DETAIL DRAWINGS (HAND DRAWN)
- RENDERED VIEW (FINAL)
- PROCEDURE REVISIONS CHALLENGES (FINAL)
- TREE DIAGRAM (FINAL)
- EXPLODED VIEW (FINAL)
- DETAIL DRAWING (FINAL)