

ENGR 141000

NX CAD Post Activity

Background

Computer Aided Design (CAD) tools support a team's construction of a solid model by creating a virtual prototype that represents their design intent. This design file can then be used to control an automated machine that can produce the part, or allow a machinist to produce it. One of the manufacturing processes discussed during the NX CAD/CAM sessions was laser cutting/engraving. For this activity, you and your team will design a small box using Siemens NX. Then, for bonus points, your team may manufacture the part using a laser cutting process in the AFL. While the outcome of your design is fairly open-ended, you are bound by several constraints.

Goal

Your team will design a six sided box to promote your team's ingenuity. The box should use a novel interlocking system to make the assembly fast and easy. The initial of each team member's first name will be cut into different side panels. The top panel will have the team number cut into it and any open sides can contain something that meets the team's promotional goals. While it is not necessary to develop an interlocking system that holds the box together without the use of adhesives, such an interlocking system could increase the ease of assembly. Meeting this requirement would be the most desirable. The resulting box might be conceptually similar to the children's tile mats that can be used as a floor mat or linked together to form a cube.



Design Requirements

1. The box must measure at least 2.0" x 2.0" x 2.0". In other words, no one face should have dimensions smaller than 2.0" x 2.0" measured from the outer edge of their interlocking system.
2. The initial of each team member's first name should appear on one of the side panels. Each initial should appear on a different side panel. When assembled, the orientation of the initials should be the same. [Each team member must design their own side panel].
3. The top panel of the box will include a pocket (hole) in the shape of the team number. This panel may be designed by a group, or by any team member.
4. Any additional panels of the box do not require a specific pocket to be constructed. As a team, you may choose to personalize the block with something that promotes the team.
5. The box must be designed so that it assembles with the letters in a common orientation. Assembly of the box could use adhesives; however, a box designed with interlocking sides would be preferable.
6. Manufacturing will be done using a laser cutter from a single 6" x 8" x 0.109" sheet of clear acrylic. All pieces of the box must be cut from the single sheet of acrylic.

Laser Cutter Specification

- Maximum Cutting Area: (20" x 12")
- Focused Beam Width: .020"
- Expected X/Y positional tolerance: $\pm .005$ "

Hints (Tips)

- Before modeling in NX, draw out your preliminary design on paper. Much like creating a flowchart before coding, it is important to have a plan before actually modeling a part.
- Consider the specifications of the machine you will use to manufacture your parts. When creating detailed parts, it is important to "design for manufacturing" to ensure that the final parts meet your design intent.

Deliverables

The design and manufacturing of the box requires a multi-phase process including: the design of each side, the personalizing of each side, the preparation for manufacturing (single file with all parts) and manufacturing (laser cutting in AFL). These phases will require a blend of individual and team efforts. The following list of deliverables and their relationship to scoring are listed below

1. **Team:** The initial plan - A **hand drawing** of the six panels laid out in a 2D assembly that illustrates the design intent of the interlocking panels. Indicate which panels are unique patterns and what will be on each panel. Scan the drawing and submit as `plan_TeamXX.pdf` where XX is the team number.
2. **Team:** An NX design layout for each unique panel design. This should be submitted as an individual file, one for each unique panel design – the file name should be `panelN_TeamXX.prt` where N is the series 1,2,3 denoting unique panels and XX is the team number. At this step, no personalization is required. It is expected that several files will be submitted – one for each unique panel design **prior to the addition of individual's initials**. Noninitial personalizing material (e.g. team number or team spirit icon) on 'empty' panels is acceptable but not required for submission at this stage.
3. **Individual:** An NX design layout for your personalized panel, with the initial of your first name. Submit a file `myPanel_login.prt`, where *login* is your personal login ID.

Manufacturing Phase – FOR BONUS CREDIT

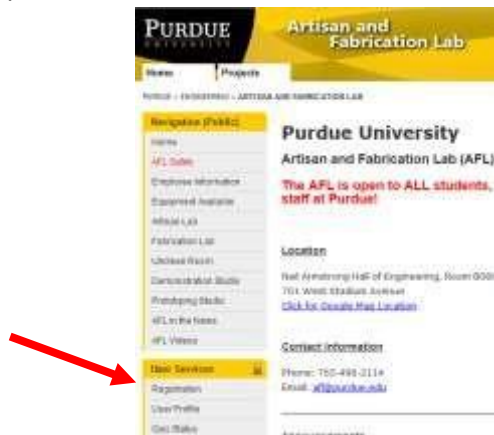
Each team member could earn 3 bonus points by participating in the manufacturing of the six panels using the AFL Laser cutter system. You will have two weeks after the posting of this document to complete the assignment. See the BBL dropbox for more information. The bonus assignment may only be performed **once per team** so all team members wishing to earn credit **must work together**. If one or more team members do not wish to participate, that is acceptable but their names should be excluded from the work and they **should not** submit the files created by other team members for credit.

Team: Generate one drawing file in DXF format that will be used for the laser cutter. This drawing file should have all six panels laid out in 1:1 scale. All 6 panels should fit in a 6" x 8" space. See the separate instructions for the steps to merge the individual files into a single document.

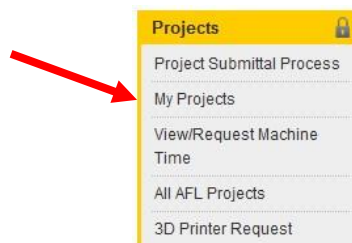
Manufacturing Phase

Following the submission of your completed design, your team will manufacture your box, on your own, using the laser cutter in the AFL. The steps you must take to begin the manufacturing process are outlined below.

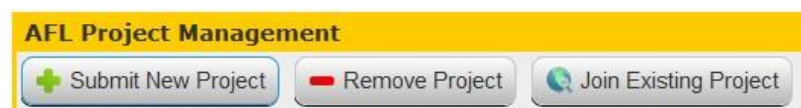
1. Each team member must register with the AFL. This may be completed by accessing the AFL website (<https://engineering.purdue.edu/afl>), clicking the "Registration" button in the "User Services" group.



1. Once all team members have registered, signed the safety contract, and passed the safety quiz, one team member should submit a project to the AFL. To submit a project, click on "My Projects" in the Projects group.



On the webpage that opens, click "Submit New Project".



2. Fill out the AFL project request form. Name your project “ENGR 141, Team XX”, where XX is your team number. Be sure to attach your DXF file in a zip folder to the “Attach Miscellaneous Files” section.
3. Once the project is submitted, visit the AFL and sign up for a one hour time slot on the laser cutter. Time slots are first come, first serve. The AFL will communicate any additional requirements to you when you sign up for a time slot.

Deliverables

1. In a PowerPoint file assemble a series of images, each on a separate slide, including:
 - a. Picture of all the participating team members in the AFL setting up the laser cutter. Include a text box with team number and list of names of team members in the photo. Do not include the names of individuals who did not participate.
 - b. The original hand drawn image of the design plan.
 - c. Image of the size panels cut out with the laser cutter and laid out flat in a pattern that illustrates the interlinking between the pieces.
 - d. Image of the assembled cube. (If appropriate, provide multiple images to highlight the interlocking mechanism, or any other points of interest).