CAD Modeling Translation

RENSSELAER POLYTECHNIC INSTITUTE

SCHOOL OF ENGINEERING

VERSION 0.7.6 (04/13)

For Use With:

1. 3-D Printing (Rapid Prototyping)
2. CAD System Translation
3. Laser-Cutting
4. Plasma-Cutting
5. Abrasive Water Jet

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RPI Manufacturing Network:
http://manufacturing.eng.rpi.edu/

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School of Engineering Manufacturing Documents

Manufacturing Technology	Room	Documents
3-D Printing (Rapid Prototyping)	CII 1027 (MILL)	1. How to Order a 3-D Part 2. Request for 3-D Part
3-D Printing (Rapid Prototyping)	Benet Laboratories	1. Current Document
Abrasive Water-Jet (AWJ)	CII 1027 (MILL)	1. How to Order an AWJ Part 2. Request for AWJ Service
Laser Cutter	CII 1027 (MILL)	1. How to Order an Laser Part 2. Request for Laser Service
Plasma Cutter	JEC 1010	1. NONE
CAD – CAM Translation	N/A	1. Current Document
Manufacturing Tech. Overview	N/A	1. Quick Start Guide for Manufacturing
Computer Numerical Control Machining	JEC 2232 (MDL)	1. MDL Drawing Templates for SolidWorks or NX

SoE Manufacturing Website

The above documents can be found on the School of Engineering Manufacturing Network Website or by contacting the personnel on the title page of this document:

http://manufacturing.eng.rpi.edu/

Outsourcing to Benet Laboratories (Watervliet, NY)

1. **Create** your model
2. **Check** information of the available SLA Machines: See Page 13
3. Initial Review: **Contact** Manager of Fabrication & Prototyping (See Page 1) with design requirements
4. Quality Check: **Send** the native geometry file(s) (e.g. *.sldprt or *.prt) to CAD Manager (See Page 1)
   4.1. If the files are too large for e-mail transfer, contact first and arrange an appointment
5. A spreadsheet will be returned to the requester via e-mail with the results
   5.1. If any parts FAIL:
      5.1.1. **Re-visit** the geometry to correct and repeat step 2.
      5.1.2. Only parts that pass the quality check will be accepted for build.
   5.2. If all parts PASS:
      5.2.1. **Follow** STL creation procedures below for corresponding resolution required
      5.2.2. **Contact** Manager of Fabrication and Prototyping to proceed with further information: build orientation, price quote, quantities, etc.
6. **E-mail** STL file created from approved model to **Manager of Fabrication & Prototyping** for a quote from Benet.
7. **Review** quote and **obtain** necessary approval for funding sources.
8. Lead Time: 5 – 7 days

Creating an STL File: SolidWorks 200x

For use with 3D Printing Facilities

1. Create your model. This model must contain at least one solid body.
2. **File > Save As**
3. Type your chosen file name in the space provided
4. Figure 1: In the **Save As** window, drop the **Save as type** list down and select **STL (*.stl)**
5. Figure 2: Click **Options** at the bottom of the **Save As** window
6. Figure 3: In the **Export Options** window, make sure **Units** and resolution settings are properly selected
   6.1. **IMPORTANT: Please know the resolution you intend to use. See Table 1.**
7. Click **OK**

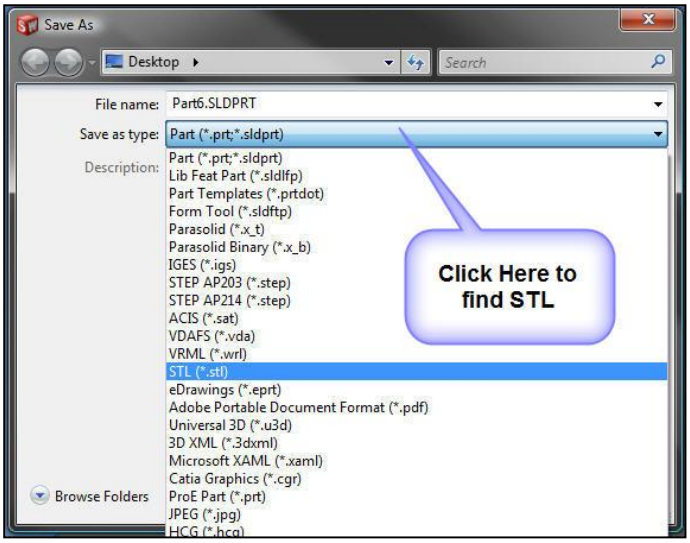

Figure 1

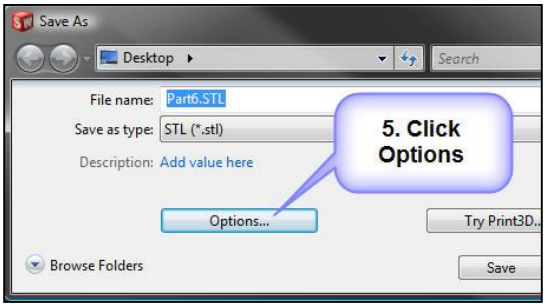

Figure 2

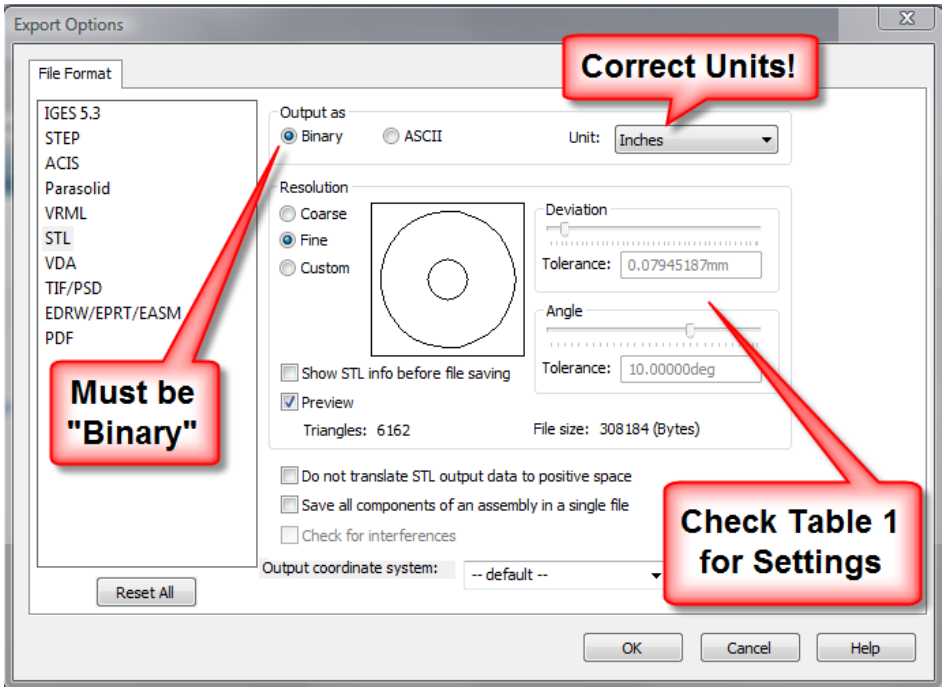

Figure 3

Table 1: SolidWorks STL Settings

Tolerance	SW Default	SW Default	RPI ABS	Benet Labs Std.	Benet Labs Fine
Resolution	Course	Fine	Fine	Custom	Custom
Deviation	-	-	-	0.001”/0.03mm	0.0002”/0.005mm
Angle	30.00°	10.00°	10.00°	10.00°	5.00°
File Size Multiplier	0.2 - 0.5	1	1	1	2 - 6

Creating an STL File: NX 5.0.1 or Later

For use with 3D Printing Facilities

1. NX 5.0.0.x is currently NOT supported for STL creation. Please use 5.0.1.x or later.
2. **Open** the model (*.prt) file.
3. Verify that the correct number of solids exist in the model.
4. **File > Export > STL**. The dialog window will open (Figure 4).
   4.1. Use Table 2 below for settings depending on desired resolution (Note: Shown settings in Figure 4 are for INCHES). Select **OK**.
5. Type the desired file name in the **Export Rapid-Prototyping** window. Select **OK**.
6. The **File Header** information window will open. Select **OK**.
7. The **Class Selection** window will open. Select the bodies (Sheets and/or Solids only) for STL generation. Select **OK**.
8. Select **OK** if the window shows negative coordinates.
9. Select **OK** if asked about error message review.

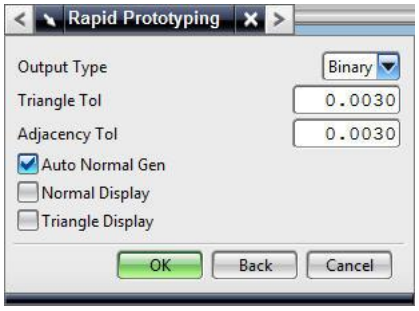

Figure 4

Table 2: NX STL Settings

Tolerance	NX Default	RPI ABS	Benet Labs Std.	Benet Labs Fine
Triangle	0.003”/0.08mm	0.003”/0.08mm	0.001”/0.03mm	0.0002”/0.005mm
Adjacency	0.003”/0.08mm	0.003”/0.08mm	0.001”/0.03mm	0.0002”/0.005mm
File Size Multiplier	1	1	1 – 1.25	1.5 - 2

Creating a DWG/DXF File: SolidWorks 200x

For use with MasterCAM, Laser-Cutter System, or Abrasive Water Jet (AWJ)

Laser-cutter line color settings:

1. Cut lines (through cuts): CYAN
2. Etch lines: RED
3. Score lines (deeper than etch): YELLOW
4. Line thickness: 0.000”

NOTE: In SolidWorks, DWG and DXF files MUST be created from the drawing document (*.slddrw).

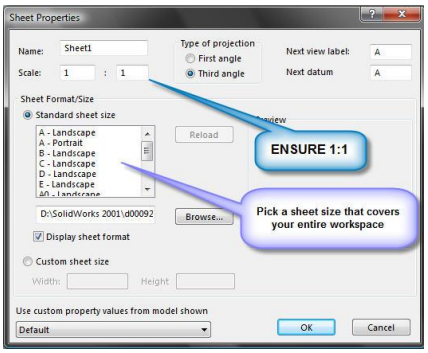

Figure 5

1. From your solid model, create a SolidWorks drawing document of your part (*.slddrw).
2. Ensure the drawing is SCALED 1:1. Right click **Sheet** > Click **Properties** (shown Figure 5).
3. Delete all borders/annotations from the template if needed.
    a. In the feature navigator, **right click** the name of the sheet and left-click **Edit Sheet Format** (shown Figure 6). All borders will become selectable. **Select** and **delete** all annotations and borders. When finished, **right click** the sheet name again and click **Edit Sheet** to exit the sheet editor.
4. Insert the appropriate views of your parts noting spacing and layout.
5. Be sure to **delete** all centerlines, axis, and dimensions.
6. Hide all origins and sketches. Select **View > Hide All Types**.
7. Steps (7) through (10) are for the LASER CUTTER.
8. Bring up the **Line Format** toolbar. **Tools > Customize**. Check **Line Format** under **Toolbars** tab.
9. Select edges of your models (use the **edge filter** if necessary – in the **selection filter** toolbar). See Figure 7.
10. Select all edges. Go to the **Line Format** toolbar. Select **Line Thickness** icon and select the thinnest setting available (first setting directly under the word “default”). All edges should become thinner.
11. Select edges (see step 6) that correspond to a certain color setting. Use the **Line Color** icon in the **Line Format** toolbar to change edges to cyan, red, or yellow depending on your design intent.
12. DWG Creation:
    a. **File > Save As**
    b. In the **Save As Type** drop-down box, select **DWG Files (*.dwg)**
    c. Type an appropriate file name of your choice
    d. Select **OK**
13. DXF Creation:
    a. **File > Save As**
    b. In the **Save As Type** drop-down box, select **DXF Files (*.dxf)**
    c. Type an appropriate file name of your choice
    d. Select **OK**

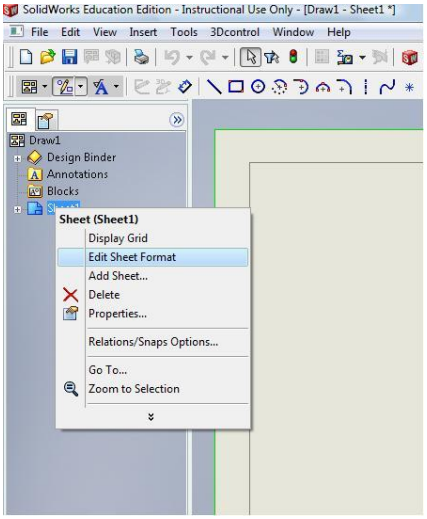

Figure 6

Figure 7

Creating a DWG/DXF File: NX 5.0.1 or Later

1. NX 5.0.0.x is currently NOT supported for DXF/DWG creation. Please use 5.0.1.x or later.
2. METHOD 1: From the model (*.prt) file:
    a. **Create** your profile or solid body.
    b. **Save** the *.prt file
    c. **File > Export > *2D Exchange***
    d. **Select** the ***Data to Export*** tab. If the work view is not the correct orientation, **Specify *Selected View*** from the drop-down list (shown Figure 8). From the view list, **select** the correct view.
    e. **Select** the ***Advanced*** tab. Make sure ***Remove Overlapping Entities*** is checked (shown Figure 10).
    f. **Select** the ***Files*** tab.
    g. Under "Export to**"** heading, **Select *DXF File*** if a (*.dxf) file is desired (shown Figure 9). **Select *DWG*** if a (*.dwg) file is desired.
    h. **Specify** the DXF (DWG) file name and path under the heading ***DXF File (DWG File)***

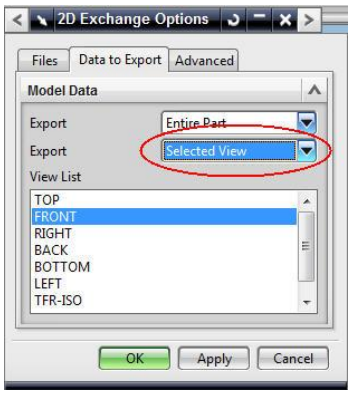

Figure 8

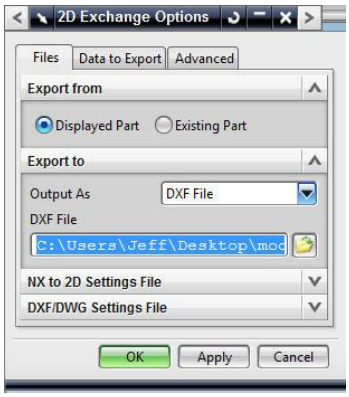

Figure 9

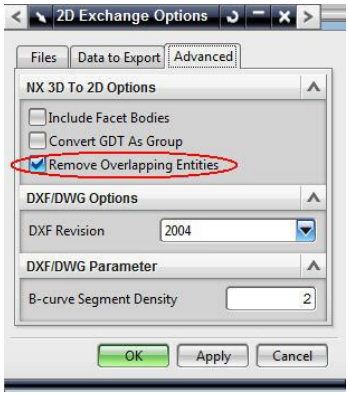

Figure 10

3. METHOD 2: From the drawing (*.prt) file:
    a. If you are using the RPI template with borders and wish to hide them within NX:
    b. **Format** > ***Layer Settings*** (see Figure 11)
    c. **Select** layers 255 and 256.
    d. **Click *Invisible***.
    e. **Click *OK***.
    f. **Remove or hide** all hidden lines, centerlines, and dimensions/annotations **(Ctrl + W)**
    g. **Hide** view boarders: **Preferences > Drafting > View > Display Boarders** (uncheck)
    h. **Ensure** the drawing sheet is scaled 1:1.
    i. **Save** the *.prt file
    j. **File > Export > *2D Exchange***
    k. See settings (shown Figure 12). Under DXF file, **select** the directory and name to save.

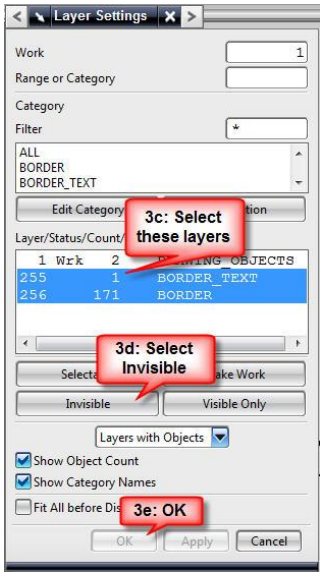

Figure 11

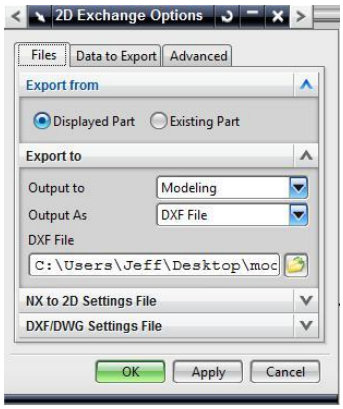

Figure 12

4. METHOD 3: From the drawing with a sketch only (most robust method):
    a. When creating the part file, only have your sketch active (suppress all solids/sheets)
    b. Follow steps (a through h) above in Method 2.
    c. In the drawing file, **right click** the part in the **assembly navigator > Replace Reference Set > Entire Part** (See Figure 13)
    d. File > Save As > (Save As Type Drop-Down **= DXF)**

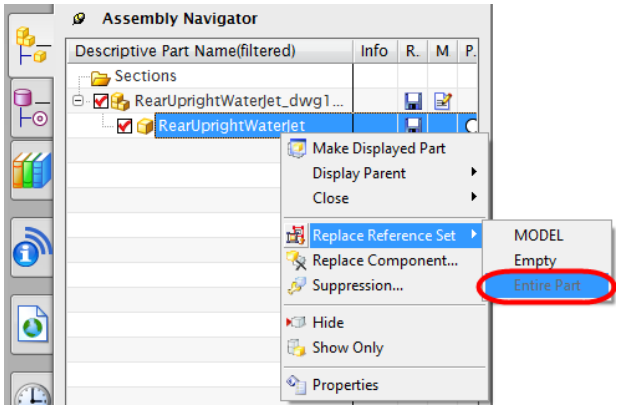

Figure 13

Exporting to Parasolid (*.x_t)

Parasolid is the most accurate translation for solid geometry between CAD and CAM systems.

NX 5.0.1.x and Later

1. With the part open, **select *File > Export > Parasolid.***
2. In the ***Version*** drop-down list, **select *17.0 – NX 4.0*** (see Figure 14).
3. **Select** the solid body or bodies you would like exported
4. **Click *OK***
5. An "Export Parasolid" window should appear. **Specify** the file name and where the file will be saved. **Click *OK.***

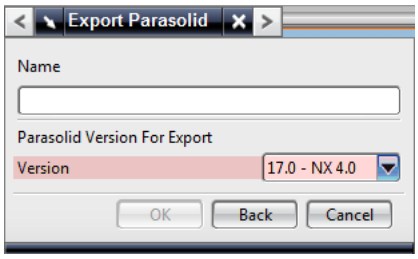

Figure 14

SolidWorks 200x

1. With the part open, **select *File > Save As***.
2. A "Save As" window should appear. In the Save as type drop-down list, **select *Parasolid (*.x_t)*** (See Figure 15).
3. **Specify** the file name and where the file will be saved. **Click *Save***.
4. NOTE: ONLY if the part has multiple bodies, the "Export" message may appear (see Figure 16). Use **Selected bodies** to choose which to export. If this window does not appear, all bodies will be exported.

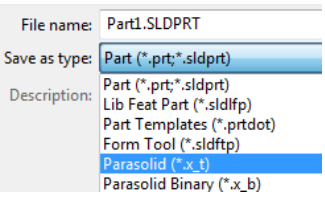

Figure 15

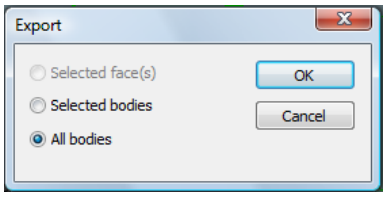

Figure 16

Benet Laboratories Stereolithography

Machine Information

Stereolithography Machines - 3D Systems Corporation (3 Vipers and 1 SLA-3500)

2 Resins in use:

- Watershed XC 11122 (durable, water resistant, nearly colorless)
- Renshape SL Y-C 9300 (FDA approved, sterilizable, selectively colorable)

Build Size:

- (13.8" x 13.8" x 15.7" cube) or (350.5mm x 350.5mm x 398.8mm)
    - Maximum unless model is created in sections and assembled afterwards

Accuracy on Z axis: (Layer Thickness Resolution)

- .002”/0.05mm Size Limitation (5" x 5" x 5" cube)
- .004"/0.10mm Size Limitation (13.8" x 13.8" x 15.7" cube)
- .006”/0.15mm Size Limitation (13.8" x 13.8" x 15.7" cube)

Accuracy on X/Y axis - (.003" per inch)

- Laser diameter on .002” layer thickness is .003”/0.08mm
- Laser diameter on .004” layer thickness is .010”/0.25mm
- Laser diameter on .006” layer thickness is .010”/0.25mm

Benet Labs Cost Estimates

Minimum Cost per job (any size, any machine): $200.00

Cost per Volume of model:

.006”/0.15mm: $165.00/$in^3$ or $0.01/$mm^3$

.004”/0.10mm: $188.00/$in^3$ or $0.011/$mm^3$

.002”/0.05mm: $281.00/$in^3$ or $0.034/$mm^3$