# Something from Nothing

## Venturer Nova Award Workbook

This workbook can help you but you still need to read the Venturer Nova Awards Guidebook.
This Workbook can help you organize your thoughts as you prepare to meet with your counselor.
You still must satisfy your counselor that you can demonstrate each skill and have learned the information.
You should use the work space provided for each requirement to keep track of which requirements have been completed,
and to make notes for discussing the item with your counselor, not for providing full and complete answers.
If a requirement says that you must take an action using words such as "discuss", "show",
"tell", "explain", "demonstrate", "identify", etc, that is what you must do.

**Counselors may not require the use of this or any similar workbooks.**

No one may add or subtract from the official requirements found in the Venturer Nova Awards Guidebook (Pub.34031).
The requirements were issued in 2018 • This workbook was updated in June 2019.

Venturer's Name: _____ Unit: _____

Counselor's Name: _____ Counselor's Phone No.: _____

http://www.USScouts.Org • http://www.MeritBadge.Org

Please submit errors, omissions, comments or suggestions about this **workbook** to: **Workbooks@USScouts.Org**

Send comments or suggestions for changes to the **requirements** for the **Nova Award** to: **Program.Content@Scouting.Org**

**This module is designed to help explore 3D printing, and how it is becoming prevalent in everyday life.**

☐ 1 Choose A or B or C and complete ALL the requirements.

☐ A Watch not less than three hours total of shows or documentaries related to 3D printing, additive manufacturing, CAD modeling, and other related fields.

| What was watched? | Date | Start Time | Duration |
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Then do the following: .

☐ 1 Make a list of at least five questions or ideas from the shows you watched.

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| 2. | |
| 3. | |
| 4. | |
| 5. | |

☐ 2 Discuss two of the questions or ideas with your counselor that relate to 3D printing and other additive manufacturing processes..

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☐ B Read not less than three hours total about anything related to 3D printing, additive manufacturing, and CAD modeling.

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☐ 1 Make a list of at least five questions or ideas from the material you read.

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☐ 2 Discuss two of the questions or ideas with your counselor.

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☐ C Do a combination of reading and watching not less than three hours.

| What was read or watched? | Date | Start Time | Duration |
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Then do the following

☐ 1 Make a list of at least five questions or ideas from the material you read.

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☐ 2 Discuss two of the questions or ideas that relate to 3D printing and other additive manufacturing processes with your counselor.

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☐ 2 Choose ONE subject from the following list. Complete ALL the requirements for a Venturing STEM exploration in that field.. (If you have already completed a Venturing STEM exploration in one of these fields, please choose a different field for this award.)

☐ CAD Modeling ☐ Additive Manufacturing ☐ Sculpting
☐ Polymers and Plastics ☐ Modern Manufacturing ☐ Inventing
☐ Wood Carving ☐ Wood Working

☐ 3 Choose three activities from the following list and complete all of the requirements..

☐ A **Design a Model**

☐ 1 Design a model of your choosing in a CAD program. Some common CAD programs with free student versions include Autodesk Inventor, Catia, CREO, Google SketchUp, Solid Works and Tinkercad.

☐ 2 With your counselor discuss what you designed and what its purpose was.

☐ Discuss what modifications you could make to the design to make it easier to 3D print.

☐ B **Investigate Model Orientation**

☐ 1 Using either the model you made in part A or a different model, load it into the 3D printing software of your choice. Adjust the orientation of the print, and note how the print time changes and how much support material is needed at each orientation.

☐ 2 Discuss with your counselor why the orientation changes the print time required, as well as the amount of support material required.

Does the fastest print time require the most support material?

What is the best orientation for your specific design?

Why does the support material change with different orientations, which gives the most efficient results?

Why does print time change with different orientations, which gives the fastest results?

Why would you not use the orientation with the fastest print time or lowest material cost?

☐ 3 Print your model.

☐ C **Investigate Model Settings**

☐ 1 Using either the model you made in part A or a different model, load it into the printing software of your choice. Adjust the model wall thickness, infill, and layer thickness, and note any changes in the amount of material used and build time.

☐ 2 Discuss with your Counselor how each setting affects the print times, what causes the least or most amount of print time

Is there a linear relationship between the settings and print time as the values are increased.

Similarly, discuss how the model settings affect the amount of material.

What combination of settings would you use for different projects?

What other settings are there that were not investigated?

☐ 3 Print your model on any setting you wish.

☐ D **Research different printing materials**

☐ 1 What different plastics are commonly used in 3D printers and what are their main differences?

What sort of projects would each material be needed for?

Which material is most common and how does the pricing vary between the materials?.

☐ 2 Investigate different metals used in 3D printing and how the layers are deposited.

What companies currently use metal 3D printing and in what sort of products is this process used?

☐ 3 Research other non-metal/non-plastic materials used in 3D printing.

What are they used for and how wide spread is their use? (Novelty or Professional)

☐ 4. Share your findings with your counselor.

☐ E **Research different printing methods**

☐ 1 Identify 3 different methods of 3D printing (these do not all have to apply to plastics and desktop printers).

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☐ 2 Determine what material is used for each printing method.

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Compare the methods against each other in terms of time to print, cost of print, pre-work, and post-work.

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What method is preferred for different printing jobs?

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☐ F **Examine the components of a 3D printer**

☐ 1 Identify 4 key parts of a 3D printer..

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☐ 2 What do they do

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and how do they contribute to the function of the printer?

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☐ 3 Report your findings to your counselor. Explain which component of a 3D printer you think is the most important.

☐ G **Investigate different printers and compare them**

☐ 1 Investigate different printers and compare them. Take note on the different materials that each printer can use, as well as the different layer height, method of printing, and available resources. Some examples include:

a. Stratasys b. Ultimaker c. Makerbot d. FormLabs e. Lulzbot

1.
2.
3.

☐ 2 Discuss with your counselor which printer you would purchase and why.

☐ 4 Choose ONE option and interview a person involved with the field. If possible, visit them in that environment to see what they do. Some possible destinations are listed below.

☐ A. Professional 3D Printing/Prototyping Lab

☐ B. University/High School 3D Printing/Prototyping Lab

☐ C. Lawrence Livermore National Laboratory 3D Printing Labs Virtual Tour (online)

☐ D. Interactive Tour of a "Form Lab" Printer

☐ Prepare at least five questions, and share what you learn with your counselor. If you take a virtual tour, with your parent or guardian's permission you can contact the organization with your questions. If that is not possible, you can discuss them with your counselor.

☐ 5 Discuss with your counselor how 3D printing affects your everyday life and what you have learned by working on this NOVA.

**When working on Nova and Supernova awards, Scouts and Scouters should be aware of some vital information in the current edition of the *Guide to Advancement* (BSA publication 33088).Important excerpts from that publication can be downloaded from http://usscouts.org/advance/docs/GTA-Excerpts-nova.pdf.**
**You can download a complete copy of the *Guide to Advancement* .from http://www.scouting.org/filestore/pdf/33088.pdf.**

**Counselor Notes:**
**Requirement 3A:**

To select an item to design, suggest the scout look around their house for common household objects that 3D printing can provide – a washer to repair a leaking faucet, a kitchen accessory, a desk storage container, an extra coat hanger, cell phone holder and sound amplifier, bag clips, etc. They could also look through a database of pre-designed objects ready for printing, such as Thingiverse.com , for ideas, but need to come up with an original design in order to meet this requirement.